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THE IMPORTANCE OF INTRAPLEURAL PRESSURE IN THORACIC SURGERY; PHYSIOLOGICAL AND CLINICAL CONSIDERATIONS

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REFINEMENTS in surgical technique have inevitably resulted in more frequent and more successful application of operative therapy to the management of tuberculous, suppurative, and neoplastic diseases of the chest. During the past two decades traumatic injuries of the thorax have also become commonplace in civil life as a consequence of the increasing popularity and accelerated pace of automotive transportation on our highways. Appreciable alteration of the intrapleural pressure, which may be either transient or permanent, is usually attendant on major thoracic operations and extensive traumatism of the chest. Such modifications of the pressure within the thorax may exert a profound effect on both the circulatory and respiratory functions. Awareness of the serious consequences of incision into the thorax is reflected in the ancient writings of Celsus (7). In modern times the development of thoracic surgery is impeded by the difficulty in overcoming the effects of disturbed intrapleural pressures, and it is imperative that the surgeon possess a thorough understanding of the physiological mechanisms and their relation to clinical situations.

PHYSIOLOGICAL CONSIDERATIONS

1. INCREASE IN INTRAPLEURAL PRESSURE

Although modification in either direction may occur, elevation (reduction in the negativity) of the intrapleural pressure is most commonly encountered by the surgeon. Increase in the intrapleural pressure is a constant accompaniment of incision through a non-adherent parietal pleura and also of those procedures, grouped collectively under the term "collapse therapy," which are designed to accomplish a reduction in lung volume. The mechanisms capable of creating an increase in intrapleural pressure include: (1) the introduction of air, oil, paraffin, or other foreign substance into the thoracic cage; (2) induced paralysis of the inspiratory muscles; (3) the interruption of the bony framework of the thorax by rib removal; and (4) compression of the chest by external pressure or by pressure applied against the inferior surface of the diaphragm.

Effects on respiration. The normal lung is a highly elastic organ which is maintained in an expanded state by virtue of the partial vacuum existing between the visceral and parietal layers of the pleura. Since the lung is in fact subjected to a considerable elastic tension or stretching, its retraction follows any reduction in negativity of the intrapleural pressure. Collapse of the lung may, therefore, ensue without the application of a compressing force actuated by a pressure greater than that of the atmosphere. This concept of pulmonary collapse by relaxation is of fundamental importance in artificial pneumothorax therapy for tuberculosis, during which extensive reduction in lung volume occurs under subatmospheric pressures provided that adhesions between the pleural leaves are absent. In 1918 Graham and Bell (17)

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proved that the effects of increasing the pressure within a hemithorax were not confined to the one side. Their experimental studies demonstrated that a unilateral pneumothorax produces an elevation of the pressure in the contralateral pleural space and concomitantly a shrinkage in size of the contralateral lung in the normal thorax. They emphasized also that the degree of transmission of pressure changes from one pleural space to the opposite depends chiefly upon the flexibility of the mediastinum. The normal human mediastinum is freely mobile within certain limits; consequently the creation of a pneumothorax on one side results in a rise in the intrapleural pressure on the other side of nearly the same degree as that induced on the side of air injection. The greater the thickening and inflammatory fixation of the mediastinal partition, the less marked are the effects on the contralateral intrapleural pressure and lung volume.

Coincident with the diminution of pulmonary volume attendant upon elevation of the intrathoracic pressure there occurs a decrease of vital capacity. This alteration in the vital capacity must be regarded as the most significant effect of chest surgical operations upon the physiology of respiration. The vital capacity, which is determined by a spirometric recording of the volume of a maximal expiration following the greatest possible inspiration, constitutes a fairly accurate index of the efficiency of the respiratory apparatus. Distressing dyspnea usually becomes manifest when vital capacity is reduced to a figure less than three times that of the individual tidal air requirement, and life obviously cannot be maintained when the maximal inspiratory effort fails to provide the necessary volume of tidal air. The most important factors determining the patient's ability to withstand unilaterally induced change in intrapleural pressure are: (1) the degree to which the alteration is transmitted to the opposite pleural space, controlled principally by the mobility of the mediastinum, and (2) the individual's vital capacity prior to production of the disturbance.

Brauer (6) postulated a mechanism of rebreathing, which he termed "pendelluft" as an explanation for the anoxemia produced by open pneumothorax. This concept, supported by observations of expansion of the lung on the pneumothorax side during expiration, hypothesizes the transfer of air from one lung to the other. During the expiratory phase of respiration, air from the lung on the sound side is presumed to enter the pneumothorax lung, the same gaseous mixture being reaspirated into the more actively functioning lung during the succeeding inspiration. Unquestionably such paradoxical respiration would lower the alveolar oxygen tension and increase the carbon-dioxide concentration. Various thoracic surgeons differ in their opinions as to the relative importance of pendulum respiration as against altered intrapleural pressure and pulmonary collapse in the causation of the harmful effects of incision into the thorax. The antithetic views of Graham and Duval will receive further consideration in the discussion of open thoracotomy.

Effects on the circulation. Graham (17), and Kountz, Alexander, and Dowell (21) have shown that an increase in intrapleural pressure produced an elevation of venous pressure. More profound effects are produced by changes in tension within the right pleural space since they are more directly applied to the right auricle and great veins. The resistance in the pulmonary circuit is also increased. In consequence of the increase in venous pressure, which may be of considerable extent when the intrapleural pressure becomes positive as in the Valsalva experiment, the return of the blood to the heart is diminished. The systolic output must diminish in accordance with the decreased diastolic inflow and therefore the systemic blood pressure falls. Head (20) has stressed the exaggeration of the Traube-Hering or respiratory waves in the blood pressure which occurs with increase in intrapleural tension, the arterial pressure being depressed more during the inspiratory than in the expiratory phase of respiration.

To-and-fro movements of the mediastinum motivated by inequality of pressure in the two hemithoraces aggravate the circulatory effects of pressure upon the heart and great veins. When the mediastinal excursions are sufficiently wide a periodic kinking results together with obstruction of both the superior vena cava above and the inferior cava below. Dolley and Wiese found that the lymphatic circulation is also slowed (12). No important detrimental effects, however, have been recognized. In fact, it is conceivable that a stimulation of fibrous-tissue production may be a beneficial result of lymph stasis in the tuberculous patient.

2. DECREASE IN INTRAPLEURAL PRESSURE

Obstructions or constrictions of the trachea or bronchi cause a fall in the intrapleural pressure. Such increases in the negativity of the pressure have been observed clinically and experimentally during attacks of bronchial asthma, in lobar atelectasis and massive collapse, and after the administration of bronchoconstrictor drugs (28). The decrease in intrapleural pressure is most

significant as a symptom indicative of the reduction in caliber of the respiratory passages. Certain important physiological changes may, however, be directly attributable to the alteration in pressure. The marked displacement of the mediastinum and its contents which often accompanies the heightened negativity of intrapleural pressure in unilateral pulmonary atelectasis may induce kinking of the great vessels, and—particularly if long maintained—the resultant strain on the myocardium may contribute to the development of cardiac decompensation. Although it has long been assumed that the pulmonary emphysema of chronic bronchial asthma is due to obstruction to the escape of alveolar air during expiration, the great negativity of inspiratory pleural pressure during asthmatic seizures may constitute an important factor in the production of alveolar dilatation and rupture. Isolated case reports indicate that spontaneous pneumothorax occasionally complicates massive collapse of the lung. Escudero and Adams (16) produced pneumothorax in dogs experimentally by obstructing a bronchus and creating an atelectasis with its attendant decrease in intrathoracic pressure. Modern concepts stress the importance of chronic lobar collapse in the pathogenesis of bronchiectasis. According to Andrus (3) the elastic hypertension associated with lowered intrapleural pressure is of fundamental importance in the development of bronchial dilatation.

CLINICAL CONSIDERATIONS

1. EMPYEMA THORACIS

The term "empyema thoracis" denotes the formation of an abscess in the pleural space. The drainage of the purulent accumulation is as essential in the management of empyema as in the therapy of pyogenic abscess situated elsewhere in the body. In order to accomplish drainage of pyogenic purulent effusions of the pleural space, three methods have been widely employed: (1) open drainage by rib resection, (2) closed drainage accomplished through an intercostal catheter connected to a water-sealed drainage bottle, and (3) evacuation by repeated thoracentesis. Open drainage following rib removal has gained the widest acceptance both because it provides a larger opening which facilitates more prompt and more complete evacuation of the abscess and because it does not require complicated apparatus. Successful application of open drainage, however, requires close observance of the physiological principles elucidated by Graham and Bell in 1918. They concluded that the premature establishment of open drainage during the early formative stage of pyogenic empyema was a dangerous undertaking, and that early operation was largely responsible for the high mortality rate in streptococcus empyema observed in the American army during the winter of 1917. At their onset, pyogenic effusions lie free and unencapsulated in the pleural space, so that incision through the parietal pleura allows access of air to the entire pleural cavity and creates an open pneumothorax. The primary effect of this open pneumothorax is a reduction in the vital capacity of the individual. Another harmful consequence is the induced to-and-fro movement of the mediastinum with its attendant pendulum respiration and deleterious effect upon the circulation. It must be remembered that pneumonic consolidation is still persistent in the early stage of empyema formation, and the consequences of open pneumothorax are far more serious when the vital capacity and general condition of the patient are already impaired by the existence of the acute inflammatory process in the lung. With the passage of time, the purulent effusion becomes encapsulated and firm pleural adhesions prevent the induction of a general pneumothorax when incision for drainage is carried out. Inflammatory induration and thickening of the mediastinum also develop with the passage of time, so that alteration of the intrapleural pressure on the affected side is less readily transmitted to the contralateral lung. A simple means for estimating the safety of open drainage operation consists in the observation of pus aspirated from the empyema pocket. When it is found that purulent exudate makes up more than two-thirds of the volume of the fluid which has been permitted to stand in a small test tube, one can feel assured that sufficiently firm encapsulation of the fluid and adequate stabilization of the mediastinum has occurred to prevent the development of open pneumothorax and the creation of a marked diminution in vital capacity by the drainage operation. One not infrequently encounters severe dyspnea or other marked pressure effects in a patient with pyogenic empyema before the stage of formation of thick pus. It is permissible to relieve the pressure by aspiration of the fluid through a needle until such a time as the consistency of the aspirated pus denotes that the abscess is localized. Drainage by a closed system is also applicable in early cases of empyema before frank pus has appeared. The negative intrapleural pressure is restored and maintained by a water-sealed system for closed drainage, since the apparatus operates on the principle of the siphon. Various surgeons have deemed it

advisable to supplement the siphon bottle with an apparatus capable of maintaining a constant negative pressure above minus 10 cm. of water (31). More rapid removal of pus and speedier obliteration of the empyema pocket are said to result from the application of suction.

2. OPEN THORACOTOMY

Management of operation. Major operations upon the thoracic contents usually necessitate the creation of a large unilateral chest opening, and it has long been realized that such incisions into the pleural space constitute a hazard to life. The dangers of open thoracotomy depend primarily upon the altered intrathoracic pressure relationships and other physiological disturbances attendant on the production of an open pneumothorax. The ability of the individual to tolerate the induced diminution of vital capacity, pendulum respiration, and circulatory changes is also of paramount importance.

The earliest attempts to conquer the effects of elevation of the intrapleural pressure comprised the construction of chambers designed to enclose the body of the patient (26), (29). By partial exhaustion of the air from such a chamber it became possible to maintain a negative pressure in the opened thoracic cavity. Separate positive-pressure compartments were sometimes employed to enclose the head of the patient in order to raise the intrabronchial pressure and further obviate the tendency toward collapse of the lungs. The technical difficulties and expense encountered in the operation of such chambers were tremendous. In order to maintain the vacuum the negative-pressure compartment must either be made sufficiently large to enclose the operating team as well as the patient, or the surgeon must face the problem of carrying out his manipulations through narrow rubber-cuffed sleeve apertures in the chamber.

The insertion of an intratracheal tube for conduction of the anesthetic mixture was proved practicable by the animal experimentation of Meltzer and Auer (25), and was introduced into thoracic surgery by Elsberg (15). It is feasible to deliver a gaseous mixture through the endotracheal catheter under pressures greater than atmospheric, maintaining lung inflation by augmenting the intrabronchial pressure to a level above that existing in the opened pleural space. Positive pressure may also be applied through a closely fitting face mask. The face piece, however, lacks certain advantages of the endotracheal tube which maintains a clear airway, provides for the direct aspiration of accumulated secretion from the trachea, and ensures transmission of positive pressure to the tracheobronchial tree. Cotton and Boothby (10) early pointed out the danger from the application of excess pressure in intratracheal insufflation anesthesia. Recently Adams (1) has considered the potential hazards in greater detail. Rupture of an alveolus with the production of emphysema of the interstitial pulmonary tissues and mediastinum may result from excessively high intrabronchial pressures (5), (23). Tear of the visceral pleura with development of a contralateral pneumothorax has also been reported as a sequel to thoracic operations performed under endotracheal anesthesia (30). While these accidents are serious complications, they do not occur frequently if moderate pressures below 10 mm. of mercury are employed. Strong manual pressure by the anesthetist on the breathing bag must be avoided. Endotracheal airways are sometimes enveloped in inflatable rubber cuffs, and a fatality following a tear of the trachea due to rupture of such a cuff has been reported (22).

Positive-pressure anesthesia with a constantly flowing gas mixture is the method in general use today for the performance of open thoracotomy. In addition to the risks enumerated above, the method possesses the disadvantage of impeding adequate pulmonary ventilation. While lung inflation can readily be maintained, ventilation is hampered by the difficulties involved in the act of expiration against positive pressure. Despite straining efforts of the patient the respiratory minute volume is usually low under the constant flow of the endotracheal anesthesia. An effective solution of the problem of maintaining ventilation consists in the perfection of apparatus capable of performing rhythmical insufflation. Recently Crafoord (11) has reported the development of such a machine which has functioned satisfactorily in 94 clinical cases.

The necessity for use of special apparatus to maintain inflation of the lungs has been seriously questioned by Duval (13). Indeed the experiences of other surgeons in the successful performance of open thoracotomy under spinal anesthesia have demonstrated that the human hemithorax may frequently be widely exposed without calamity (14). Duval claimed that a small incision into the pleural space produced more serious disturbance of the respiration than wide opening of the chest. According to his viewpoint, fluctuation of the mediastinum is chiefly responsible for the respiratory distress associated with open pneumothorax, and as the size of the chest opening is increased the stabilization of the mediastinal par-

tition is effected. This concept neglects recognition of the reduction of the vital capacity of the contralateral lung. Individuals with sufficiently high initial vital capacities withstand open thoracotomy without the application of positive-pressure anesthesia. Experience has demonstrated that many patients will succumb under these conditions, however, so that one must have available provisions for the application of pressure—whether through a face piece or intratracheal catheter.

Postoperative readjustment. Closure of the thoracic wall is rendered as nearly airtight as possible by careful suture of the intercostal and overlying muscles. Immediately before the closure of the pleura the anesthetist raises the gaseous pressure slightly to produce almost complete reinflation of the lungs. The negative intrathoracic pressure is established before completion of the operation. We have had frequent occasion to measure the pressure in the pleural space within the first twenty-four hours of the postoperative period and have always found it to be minus in the absence of gross leakage from the lung or bronchus. After major intrathoracic operations the traumatized serous surface regularly pours out a serosanguineous exudate into the hemithorax. Large accumulations elevate the intrapleural pressure and produce sufficient dyspnea and discomfort to require one or more aspirations.

Drainage should ordinarily be provided at the time of operation if there is great likelihood of the development of postoperative empyema or considerable risk of subsequent reopening of a ligated bronchial stump, as for example in the performance of lobectomy for bronchiectasis. Obviously the drainage apparatus must consist of an airtight catheter system such as that described in the discussion of empyema thoracis. Any form of open thoracostomy would merely continue the open pneumothorax present during operation and would jeopardize recovery in any but the most vigorous patient. The siphon action of a water-sealed drainage system contributes sufficient suction to aid in maintenance of a negative intrapleural pressure. The degree of negative pressure developed depends in part upon the vertical distance between the level of the intrathoracic tip of the catheter and the fluid level in the drainage bottle which is placed in a dependent position. Various other types of suction apparatus have also been connected to the intercostal catheter with the object of inducing more rapid reëxpansion of the lung. Strongly negative pressures, above 20 mm. of mercury, may increase the amount of hemorrhagic intrathoracic exudate and are, therefore, to be avoided.

3. THE COLLAPSE THERAPY OF PULMONARY TUBERCULOSIS

Those procedures incorporated under the term "collapse therapy" comprise certain surgical or mechanical methods capable of effecting a reduction of the volume of one or both lungs. Their beneficial action in pulmonary tuberculosis appears to be chiefly attributable to the obliteration of existing tuberculous cavities. Respiratory excursions are regularly diminished by collapse methods, and the decreased lung volume combined with the reduced mobility effects a significant decrease in the vital capacity. Increase in the intrapleural pressure is a constant accompaniment of effective collapse therapy, since appreciable diminution of pulmonary volume cannot be achieved without decreasing the partial intrathoracic vacuum which maintains the lungs in an expanded state.

Artificial intrapleural pneumothorax is the most widely employed collapse procedure. It requires greater knowledge and closer observation of intrapleural pressures than the other common methods of collapse therapy.

At the time of the initial inflation the situation of the injecting needle in a free pleural space is determined by the manometric pressure readings. Intrapleural pressures are negative and are characterized by free oscillations of pressure with respiration greater than 2 mm. in extent. The average values on inspiration and expiration are −8 and −4 cm. of water, respectively. There is, however, not only a variation between different individuals but also a variance between the readings obtained at different locations in the same person (24). If the pneumothorax needle is inadvertently introduced through the parietal pleura into pulmonary alveoli one may record a pressure fluctuating about the atmospheric level. Negative pressures up to −6 cm. of water may be recorded when the tip of the needle enters a pulmonary vein, but the respiratory fluctuation characteristic of intrapleural readings is absent. If calamities are to be avoided it is imperative that air be injected only after the pressures denote that the tip of the pneumothorax needle lies in the pleural space.

The extent of the pulmonary collapse attained through injection of air into the pleural space cannot be gauged accurately by the rise in intrapleural pressure. Protracted experience with an individual patient, however, enables one to reach some correlation between the roentgenographic

appearance and certain pressure levels. Variability of the relationship of the collapse produced to the intrapleural pressures created in any pneumothorax patient is determined principally by the following factors: (1) adhesions between the visceral and parietal pleura, (2) the elasticity of the lung, and (3) the mobility of the mediastinum. Adhesions limit the size of the pneumothorax pocket, so that in their presence a given amount of air will produce a greater than normal elevation in intrapleural pressure. We have repeatedly seen marked increase in the size of the pneumothorax cavity and the extent of pulmonary collapse without increase of the intrapleural pressure follow the successful division of pleural adhesions by closed intrapleural pneumolysis. The rapidity of pressure rise with a standard volume of injected gas is in inverse ratio to the elasticity of the lung. Christie and McIntosh (8) measured pulmonary elasticity by simultaneous calculation of the tidal air volume and intrapleural pressure. It may be assumed that the difference between expiratory and inspiratory pleural pressures approximates the distending force applied to the lung during inhalation. Pulmonary distensibility (elasticity) might, therefore, be expressed as a ratio of the volume of air inspired to the distending force or change in intrapleural pressure.

We have on many occasions observed that the majority of pneumothorax patients exhibiting thick visceral pleuræ and densely fibrotic lungs in the roentgenogram show marked respiratory excursions of pleural pressure during quiet breathing. Further, it is customary to find that marked rises in mean pleural pressure follow the injection of relatively small quantities of gas into the pneumothorax spaces surrounding such inelastic lungs. The importance of mediastinal fixation in determining the relation of the degree of collapse of the ipsilateral lung to the elevation of pressure produced by an inflation is obvious. When the mediastinum is mobile the increases in intrapleural pressure are shared by both pleural sacs. Rigidity of the mediastinum limits the effects of pneumothorax principally to the side of the air injection, and the intrapleural pressure on this side is therefore elevated to a greater extent by each therapeutic inflation.

In the absence of pleural adhesions excellent collapse may be achieved with subatmospheric intrapleural pressures. Repeated successful experiences under these conditions lend credence to the contention that relaxation of contracting scar tissue with its centrifugal pull on the cavern walls is of fundamental importance in the production of cavity closure. Actual compression of a lung by creating a pressure above the atmospheric has in our experience increased certain complications of pneumothorax therapy, notably, herniation of the mediastinum, effusion, and empyema, and we, therefore, avoid the use of high pressure. The lung on the side of a closed intrapleural pneumothorax is seldom completely immobilized. So long as the intrapleural pressure may be rendered negative in the inspiratory phase the lung is capable of performing a respiratory function. These considerations explain the practicability of bilateral pneumothorax in selected patients.

Careful observation and recording of intrapleural pressure may reveal the existence of a small fistulous communication between the lung and the pleura. Large fistulas render the pressures intrapulmonic; small and intermittent leaks are associated with persistence of pulmonary collapse and relatively high intrapleural pressures maintained for long periods without air refills. The importance of detection of these pleuropulmonary perforations lies in the fact that they ultimately lead to the production of tuberculous empyema in the majority of instances. Coryllos (9) pointed out that analysis of the pneumothorax gases is more exact in diagnosis of the smaller fistulas than are pressure determinations.

The development of a fluid exudate in the pneumothorax space is a frequent complication. When the exudate becomes large in amount it causes an unfavorable redistribution of pressure relationships, since the hydrostatic effect of the fluid tends to create the highest pressure over the most dependent portion of the thorax whereas the tuberculous process which one desires to collapse is usually situated in the upper portion of the thorax. It is also true that exudate may provoke adhesion formation and subsequently limit the capacity of the pocket despite the maintenance of high intrapleural pressure. During the reëxpansion period after voluntary abandonment of pneumothorax it is not unusual to remark the appearance of pleural fluid. Such reëxpansion exudates develop by predilection in patients with relatively fibrotic lungs who have markedly negative intrapleural pressures when air refills are discontinued. The fluid may perhaps represent a "transudate ex vacuo" which is literally sucked into the pleural space by the highly negative pressure.

Phrenic-nerve interruption ordinarily produces a definite elevation of the intrapleural pressure. The change is usually proportionate to the resultant upward displacement of the diaphragm. Haight and Deegan (18) found an average rise of

2.4 cm. of water in mean intrapleural pressure in a group of 7 pneumothorax patients subjected to ipsilateral hemidiaphragmatic paralysis.

Thoracoplasty involves the surgical extirpation of ribs or rib segments with the object of obliterating empyema cavities or collapsing tuberculous lung tissue. The dissection employed in the resection of ribs for the treatment of pulmonary tuberculosis is extrapleural. There is no occasion, therefore, to make provision for positive-pressure anesthesia. Exact data on the effect of thoracoplasty on the intrapleural pressure are difficult to obtain, since the operation is seldom attempted in patients with free pleural spaces suitable for pressure determinations. It is, furthermore, the accepted practice to discontinue an ineffective pneumothorax and permit complete reëxpansion of the lung before proceeding with thoracoplastic collapse, and therefore there is not a convenient air pocket available for postoperative pressure measurements. On 2 occasions when thoracoplasty was performed over a pneumothorax, we have found that the intrapleural pressures, which were previously below atmospheric pressure, became positive following rib removal. If fluid or air is present in the pleural cavity pre-operatively, efforts should always be made to aspirate it or to determine the intrapleural pressure on the operating table after closure of the incision. The additional elevation ensuing upon the thoracoplastic collapse may raise the intrapleural pressure to dangerous levels.

The mechanism of collapse by thoracoplasty does not depend upon positive-pressure compression of the lung. The objective is the performance of an extensive decostalization of the thoracic wall, which permits the soft tissues to retract and the underlying lung to relax under atmospheric pressure. Mobilization of the apex of the lung (apicolysis) may have merit in some cases by virtue of the more complete retraction of the upper lung which ensues when the fascial attachments to the apical pleura are released. Many of the braces devised for application over the decostalized areas of the chest provide positive pressure. The chief advantages of a brace, however, consist in its ability to minimize paradoxical respiratory movements of the chest wall and its capacity to maintain the soft tissues in the retracted position created by operation until rib regeneration provides a relatively rigid costal wall at the depressed level.

Paradoxical respiratory movement of the chest wall following extensive rib resection constitutes one of the most dangerous physiological disturbances produced by thoracoplasty. The soft tissues over the decostalized areas tend to fall inward as the negative intrathoracic pressure is increased during inspiration. The greater negativity of pressure in the opposite pleural space during the inspiratory phase creates a movement of the mediastinum toward the contralateral side. During expiration the mediastinum, collapsed lung, and decostalized chest wall shift in the opposite direction. There exists, therefore, both a to-and-fro movement of the mediastinum, which has a deleterious action on the circulation, and a tendency to pendulum respiration which causes anoxemia. A fall in the blood pressure, acceleration of the pulse, dyspnea, cyanosis, and collapse are among the signs associated with extensive paradoxical movement. It must be recognized, of course, that operative shock, autotuberculinization, spreading tuberculous disease, and other factors may also account for similar postoperative syndromes. Oxygen, blood transfusion, and snug strapping over the affected area constitute the usual therapy for this postoperative difficulty. Alexander (2) successfully employed the Drinker respirator to overcome paradoxical movement and associated severe post-thoracoplastic shock.

Extrapleural pneumolysis consists in the surgical creation of a space between the parietal pleura and the loose fascial covering of the inner surface of the bony thoracic cage. Pulmonary collapse is achieved by manual depression of the lung and is maintained by the introduction of various foreign substances into the pocket thus established. The recent popularity of air filling (extrapleural pneumothorax) has made possible the study of pressure relations in this intrathoracic extrapleural space. The behavior of pressures is similar to that in a limited intrapleural pneumothorax. Positive pressures between 10 and 20 cm. of water are achieved and usually must be maintained to prevent reëxpansion. Extrapleural pneumolysis represents a compression type of collapse in contrast to the relaxation collapse achieved at lower intrathoracic pressures by other methods of therapy. It is rather generally conceded that more satisfactory results are secured by a good intrapleural pneumothorax or a thoracoplasty, but it is not certain that this difference in clinical accomplishments is a manifestation of the difference in pressure mechanisms involved.

4. TRAUMATIC INJURIES OF THE THORAX

Both penetrating and non-penetrating injuries of the chest may produce significant alterations in the intrathoracic pressures.

Large wounds extending through the parietal pleura produce open pneumothorax unless there

is firm symphysis between the visceral and parietal surfaces of the serous membrane. The seriousness of this disturbance is portrayed by the high mortality rate of such traumatism during the first twenty-four hours. Infection of the lung or pleura may develop later, but open pneumothorax superimposed on shock and hemorrhage constitutes the chief immediate hazard to the life of an individual with an open sucking chest wound. Such wounds must, therefore, be closed without delay and with but scant regard for the possibility of subsequent pleural infection. Transforming an open to a closed pneumothorax decreases the mediastinal mobility and pendulum respiration. The intrapleural pressure is reduced and the vital capacity immediately increased in consequence. In emergencies open wounds should be covered with heavy dressings to minimize respiratory distress and fatigue while facilities for surgical closure are being prepared. Recurrence of dyspnea usually indicates that either blood or air is entering the pleural cavity. The management then is similar to that of non-penetrating wounds.

Penetration by small missiles or by the jagged ends of fractured ribs may create hemothorax or pneumothorax in the absence of a patent wound extending from skin surface through the pleura. Frequently the resultant closed pneumothorax is of the dangerous valvular or tension variety characterized by positive intrapleural pressures and increasing respiratory and circulatory distress. Prompt recognition of these conditions is imperative—it usually must be based upon the clinical picture since roentgenological facilities and instruments for the mensuration of pleural pressure are seldom immediately at hand. Deviation of the trachea and apex beat away from the side of the pleural accumulation and diminished breath sounds over the involved hemithorax are the most important signs of traumatic hemopneumothorax. The increasing intrapleural pressure diminishes the vital capacity and venous return to the heart, the latter action augmenting the effects of trauma and blood loss in producing shock. Emergency treatment consists in the aspiration of blood or air, if required by symptoms of respiratory embarrassment. The usual measures employed in combating shock are also applicable with one notable exception, namely, that the patient with markedly elevated intrathoracic pressure will seldom tolerate the supine position and must be placed in a semi-sitting posture to minimize the dyspnea. After transportation to the hospital the pressure manometer furnishes a helpful guide to further management. If a large hemorrhage into the pleural space has occurred, aspiration becomes necessary to relieve the distress occasioned by the pressure. The removal of the blood reduces the pressure and alleviates the associated symptoms, but too marked a lowering of the pressure may promote further hemorrhage. In most cases a satisfactory solution of this dilemma consists in aspiration of the blood and replacement with sufficient air to maintain the mean intrapleural pressure at an atmospheric level. In relief of tension pneumothorax, it is not advisable to reduce the intrapleural pressure much below the atmospheric pressure because a vacuum tends to reopen the wound in the visceral pleura. Should positive pressures keep building up in the pleural cavity after several aspirations a catheter must be inserted to provide continuous relief.

Crushing injuries of the chest may produce emphysema of the interstitial tissues and mediastinum. This may be the result of the rupture of an alveolus or even of a tear of a major bronchus. The investigations of Nissen (27), and Francis and Ballon (4) indicate that the first effect of increased intramediastinal pressure is compression of the great veins. The syndrome of cardiac tamponade, characterized by a marked fall in the systolic blood pressure, a rise in the venous pressure, and muffling of the heart sounds, may ensue if the pressure elevation is sufficiently great. Several pathways of escape usually prevent the building up of high intramediastinal tension, however. The air may ascend to the neck, descend into the retroperitoneal fascia, or dissect extrapleurally anteriorly and posteriorly. Recognition of traumatic mediastinal emphysema depends chiefly upon the notation of subcutaneous crepitation occurring in the episternal notch and spreading lateralward and on the roentgen demonstration of air within the mediastinum. A curious popping or crunching sound synchronous with cardiac systole has been described (19) and has been audible in several cases of mediastinal emphysema observed by the authors. Skin incisions in the episternal notch with application of the suction apparatus have been advocated for relief of intramediastinal tension, but it appears probable that spontaneous recovery ensues when alveolar rupture is responsible for the emphysema, and that fatalities occur regardless of such treatment when a major bronchus has been ruptured.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Dandy, W. E.: Removal of the Longitudinal Sinus Involved in Tumors. *Arch. Surg.* 1940, 41: 244.

Occasionally dural meningiomas invade the longitudinal sinus. In these cases, unless the affected part of the longitudinal sinus is resected there is no possibility of curing the tumors. The tumors may be unilateral or bilateral. They frequently occlude the longitudinal sinus either by compression or invasion, so that removal of a section of the longitudinal sinus affects the demand for a collateral venous circulation very little or not at all. In these cases the venous obstruction has, doubtless, been gradually progressive, and there has been time for the collateral circulation to develop. It is not known whether a patent sinus can be resected.

The author reports on 9 cases from the literature and 4 cases of his own. The operation in all of the cases except 1 was successful, and there were no postoperative disturbances attributable to the resection of the sinus.

Clinically the most constant features are headache, a swelling on the head, and convulsions.

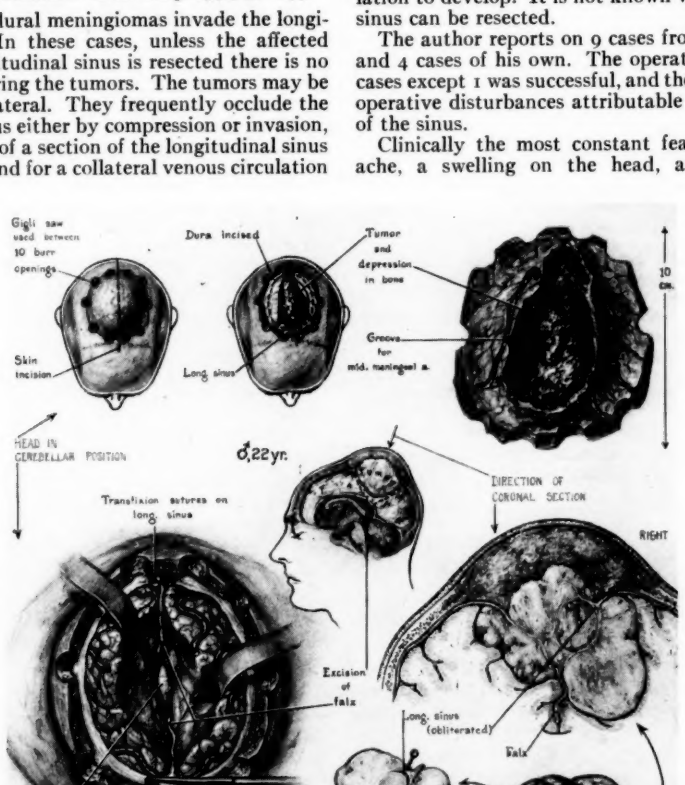

Fig. 1. Operative sketch showing the bone removed, the excavation of the hyperostosed bone, the position and character of the tumor, and the effect on the longitudinal sinus. The operative view of the removal of the tumor and the longitudinal sinus is shown in the larger sketch on the left.

There may be additional symptoms which depend upon the location of the tumor. The x-rays show hyperostosis. The operation is described.

DAVID J. IMPASTATO, M.D.

Keith, Sir A.: Concerning the Origin and Nature of Certain Malformations of the Face, Head, and Foot. *Brit. J. Surg.*, 1940, 28: 173.

For more than thirty years the author has been interested in a satisfactory explanation of congenital malformations, especially congenital buccal grooves and creases. In a well written and generously illustrated article, many arguments are given which seem to present ample proof for the conclusions offered.

As the first evidence that the explanation lies in a temporary or permanent breakdown in the circulatory system of the fetus, Keith reviews in some detail the embryological research of George L. Streeter. Microscopic sections of fetal constricting bands, such as lead to intra-uterine amputation, show that the base of the cord appears to issue from the deep fascia and passes through the epidermis. Circumstantial evidence points to the end of the second month of development as the period at which the toes and fingers, the most common sites of this disorder, are just assuming their discrete shapes.

In nearly all of Streeter's cases examination of the placenta and umbilical cord revealed evidence of defect and circulatory failure. At the end of the second month the placenta is undergoing rapid expansion and is therefore in its most vulnerable phase of growth. Circulatory disturbance in the fetus results in a fibrous outgrowth, such as a cord or a band, because the skin and fascia fibroblasts respond in a particularly vigorous manner when deprived of their blood supply. Cardiac circulation is not fully established until toward the end of the second month, and the amniotic fluid provides a particularly favorable tissue-culture medium. Thus at these sites of tissue, injuring cords or "amniotic bands" form, a process which the author terms "Streeter's Fetal Dysplasia."

Illustrations and conclusions from the researches of Ellen B. Finley are reviewed; they offer proof that the fetal scalp is not invaded by new vessels sprouting from the old but that the scalp mesenchyme just in advance of the growing margin becomes transformed into red blood cells and vascular endothelium. Thus if during this process a partial or temporary breakdown occurs in the placental circulation the chief damage would be at the growing margin of vascularization, which would result in a margin of dense fibrous tissue. This could be somewhere along the extremities as well as on the scalp, because at the end of the second month of development the distal parts of the human extremities are still in the capillary stage of vascularization.

As further evidence that congenital scars, defects of the scalp, meningoceles, spina bifida, and the various degrees of anencephaly are probably the result of circulatory failure, which may be placental in origin, the author cites the embryological research of H. W. Ingalls. He also calls attention to the fact that the dysplasia may involve an irregular area of dermal and subdermal tissues as well as the linear form as seen in the digital bands.

The various forms of dysplastic lesions of the face, including buccal grooves and creases, median cleft of the lower lip and mandible, oral temporal cleft, fissure from lip to eyelid, band from tongue to palate, and the more extreme fetal defects such as anencephaly are then discussed and well illustrated. Again the conclusion is drawn that all such lesions are caused by a local necrosis probably due to a circulatory failure which may be placental in origin. These lesions become manifest at two stages of human development, both toward the end of the first and toward the end of the second month.

Amniotic adhesions are shown to be always produced by and from the fetus and never by a failure in the separation of the amnion from the embryo. Thus they are the result and not the cause of fetal malformations.

The experiments of H. J. Bagg, who by small doses of x-ray damaged the parent germ-plasm and produced a strain of mice which were particularly liable to dysplastic lesions of the feet, convinced the author that club-foot in all its human forms is but one of the many ways in which Streeter's dysplasia becomes manifest in our fetal bodies.

LOUIS T. BYARS, M.D.

EYE

Souders, B. F.: Transcranial Extirpation of a Fibrohemangioma of the Orbit; Report of a Case. *Arch. Ophth.*, 1940, 24: 539.

"Hemangioma of the orbit is considered by Benedict and Love, Reese and others to be the most common type of primary intraorbital tumor. The typical case is one in which slowly developing but variable unilateral exophthalmos occurs, usually in the first or second decade of life. Exophthalmos is usually 'straight forward,' and the degree of exophthalmos may increase with dependent posture of the head or with compression of the jugular vein. It is not usually pulsatile, nor is a bruit commonly heard. Vision is not significantly affected unless the tumor becomes large or is situated within the muscle cone. Limitation of ocular rotations seldom occurs. A portion of the cavernous type of angioma is sometimes present in the lid or conjunctival sac, but the fibrous type, which is usually located in the posterior portion of the orbit, may give no external evidence of its nature.

"Unilateral exophthalmos is frequently the only symptom presented by the patient with a vascular tumor of the orbit. Its presence indicates the need for exhaustive study to exclude exophthalmos of extraorbital origin. If one suspects a primary tumor to exist in the orbit, hemangioma should be among the first possibilities to consider in the differential diagnosis. Rapid regression of exophthalmos after

irradiation may confirm the diagnosis, since this type of tumor is quite radiosensitive. It must be admitted, however, that a careful study of many cases of unilateral exophthalmos frequently fails to establish a preoperative pathologic diagnosis or even an exact anatomic location of the lesion.

"The uncertainty of the position and nature of the growth makes the choice of operation difficult if operation is decided on. The orbital approach, as outlined by Elschnig, may be directed through the conjunctiva, through the skin of the lids or through an opening created by an osteoplastic flap of the malar bone—the Kronlein procedure. Exenteration of the orbit, of course, constitutes another operative measure. The usual approaches are satisfactory for tumors in the anterior aspect of the orbit. They frequently prove inadequate, however, when removal of a tumor from the posterior portion of the orbit is attempted. Unnecessary trauma to vital orbital structures may result, or the tumor may be incompletely removed, a fact of serious importance if intracranial extension has taken place. It must also be remembered that copious hemorrhage, which occurs commonly in the removal of highly vascularized tumors, may be extremely difficult to control.

"The inadequacy of the usual methods of approach to the orbit has led to a consideration of a transcranial procedure. Benedict and Adson in 1934 reported a case in which transfrontal craniotomy was done with unroofing of the orbit to effect the removal of an intraorbital tumor. Naffziger previously hinted at the feasibility of the operation in his description of orbital decompression for malignant exophthalmos. Dandy in 1922 reported a somewhat similar procedure for the treatment of intracranial tumors of the optic nerve. The approach is obviously neurosurgical, but it does not possess the gravity of the usual craniotomy, since it is entirely extradural. The procedure permits satisfactory exploration of the orbit and contiguous cranial cavity and offers accessibility to tumors in these areas.

"The case reported here represents one in which a retrobulbar orbital neoplasm was suspected. A transcranial surgical approach to the orbit was made which permitted successful, complete removal of an encapsulated fibrohemangioma of the posterior orbit."

LESLIE L. MCCOY, M.D.

Savin, L. H., and Tyrrell, T. M.: A Preliminary Note on the Use of Retrobulbar Proctocaine Anesthesia for the Relief of Intractable Ocular Pain. *Brit. J. Ophth.*, 1940, 24: 560.

Savin and Tyrrell of London report that relief from prolonged and severe pain in an eye retaining useful vision is often difficult. Ophthalmic pain can sometimes be unbearable, especially in elderly patients. Measures such as the application of heat, the use of leeches, and sedatives are often ineffective. Anesthesia by means of the retrobulbar injection of procaine solution though effective affords only transitory relief.

Since January, 1940, they have been experimenting in intractable cases with the retrobulbar injection of "proctocaine," and have acquired enough data for a preliminary report of what promises to be a valuable therapeutic procedure.

Retrobulbar injections of proctocaine were performed for 18 painful eyes. In 11 cases the pain was completely relieved, and in 5 cases it was partially relieved. There were 2 failures, one due to a faulty injection, the other was unexplained.

Corneal sensibility was carefully tested both before and after the injections. Usually the sensitivity was lowered, but it was never completely absent after the injection. The authors believe that particular care should be taken when retrobulbar injections are given in cases in which the corneal sensitivity is lowered. They have seen no neuroparalytic keratitis after these injections, but they believe that the patients should be kept under observation.

The 2 cases of diplopia following proctocaine injection both cleared rapidly. Their occurrence did not surprise them, as a sector of the sphincter ani is often temporarily paralyzed when an anal fissure is injected with proctocaine. In both cases the injection was given rather far back inside of the muscle cone. Patients with good vision in a painful eye should be warned of the possibility of temporary diplopia before the injection is given. Fortunately an intolerably painful eye usually has reduced vision, so that diplopia would not be noticed in such cases.

None of the authors' patients showed any sign of toxic symptoms following the injection. Proctologists sometimes use from 20 to 30 c.cm. with impunity.

Comparatively small amounts of the proctocaine have so far been employed because of doubt as to whether the almond oil would be absorbed from the orbit. In 2 cases some of the oil came forward subconjunctivally. In one case it disappeared in a few days, in the other it remained on view for three weeks. It is generally supposed that the vegetable oils become emulsified after injection into the body and are gradually absorbed. Pending accurate information the authors have so far deemed it unwise to try a second injection when the first was not entirely successful. Experimental work on the absorption of oil would be helpful.

Proctocaine was employed because it was the only preparation readily obtainable on the market for prolonged anesthesia. The proportions of the ingredients were originally planned for effective rectal and anal anesthesia only. Modifications of the constituents might quite probably give a better solution for orbital use. Further research would seem indicated.

If proctocaine is employed for the relief of pain in a blind eye, all possibility of neoplasm should be excluded. Proctocaine retrobulbar injections can be safely recommended for painful eyes with full corneal sensibility and poor vision. If vision is good in a painful eye, the possibility of producing temporary diplopia by the injection must be remembered.

Neuroparalytic keratitis is a theoretical possibility if corneal sensitivity is unduly lowered, but so far this complication has not been encountered in practice. LESLIE L. MCCOY, M.D.

Terry, T. L., and Chisholm, J. F., Jr.: Studies on Keratoconus Relative to the Effect of the Prolonged Application of Pressure. *Am. J. Ophth.*, 1940, 23: 1089.

The authors state that from their studies of keratoconus and their successful experience in applying pressure to cure the corneal deformity, the following facts should be stressed and the following conclusions drawn:

Thinness in the central area of the cornea appears in the embryo and persists through life; it represents a physiological keratoconus.

The tensile strength of the cornea depends primarily on the white fibers of the substantia propria and the forces binding them together. Secondarily, elastic fibers lend strength when the cornea is distended.

If elastic tissue is an important constituent of the cornea, conditions causing elastic-tissue degeneration, such as stria gravidarum, pseudoxanthoma elasticum, pinguecular formation, and even the elaboration of relaxin during pregnancy, may be of some etiological importance in keratoconus.

The greater number of lamellæ at the periphery strengthens the cornea here.

A hereditary weakness of the cornea need not manifest itself until puberty or early adult life when the eye is subjected to its greatest pressure—except during parturition—perhaps, because of the stresses of life.

The possible value of pressure treatment in progressive myopia and other scleral ectasias should be investigated.

1. The essential pathological process of keratoconus has not been observed since all the pathological material studied represented late stages of the disease complications and often it was not seen until after surgical treatment had altered the picture.

2. As no lamellæ extend over the entire cornea, any overdistention sufficient to disrupt the connection and adhesion of the lamellæ would cause a slipping of the layers and thus produce an ectasia of the cornea.

3. As determined from testing the tensile strength of corneal strips, the rabbit cornea should rupture at an internal pressure of 697 mm. of mercury.

4. The fact that small degrees of keratoconus are relatively frequent is observable upon painstaking examination of many patients with over 3 diopters of astigmatism especially if one meridian of the error of refraction is myopic.

5. The development of keratoconus lacks sufficient irritation to stimulate scar-tissue formation until late in the growth of the deformity.

6. Pressure treatment, the full value of which has hitherto been unrealized, reduces the deformity in some instances and gives permanent cure of the disease if the pressure is maintained sufficiently long (at least ten weeks) to allow the scar-tissue repair to mature enough to hold the newly attained more or less normal thickness of the cornea.

7. The eye rotates freely under the pressure bandage.

8. The cure of the corneal deformity may arise (a) through irritation and a reaction of fibrous-tissue growth brought on by almost continuous change in the pattern of folds and wrinkles of the cornea under compression incident to rotation of the eye; and (b) through the normal tendency of the cornea and sclera to contract and thicken when intra-ocular pressure is lowered indirectly by greatly elevating the extra-ocular pressure with the pressure bandage.

9. Complications of variable importance commonly encountered in pressure treatment are corneal scar (in all cases), ciliary injection, and spastic miosis during the period of treatment, vascularization of the cornea, and erosion of the cornea.

10. Since the pressure bandage is to be used for ten weeks, it must be applied more carefully than usual to avoid skin irritation and chafing of the forehead and ears.

11. Pressure treatment at the present time should be limited to patients who have keratoconus of considerable amount with reduced visual acuity not improved materially by contact glasses.

LESLIE L. MCCOY, M.D.

Sorsby, A.: The Dystrophies of the Macula. *Brit. J. Ophth.*, 1940, 24: 469.

In this article the author concludes that macular dystrophy presents such a protean range of manifestations that the classification suggested by Behr, helpful as it has been, must be regarded as distinctly schematic. The range of ophthalmoscopic appearances extends from faint mottling of the macular zone to the picture seen in Doyne's choroiditis, almost every possible intermediate lesion having been reported. The conception of a distinctly isolated macular lesion is not valid. There may be present not only extensive perimacular involvement but also peripheral lesions, and some general involvement of the whole fundus is not excessively rare. One case is reported showing the association of macular dystrophy with typical retinitis pigmentosa. A rigid classification of the macular dystrophies on a chronological basis involving distinct age groups, as postulated by Behr, is not borne out by experience. The age of incidence extends, just as the ophthalmoscopic appearances, over a continuous unbroken range.

The apparent complexity of abiotrophic central lesions of the fundus lends itself to considerable simplification. Three clear-cut types are recognizable.

(1) Central choroidal sclerosis as shown in a previous article. Here the primary lesion develops in the vascular bed of the choroid.

(2) Angioid streaks—which must now be regarded as part of the generalized process of elastosis dystrophica—produced by ruptures in the membrane of Bruch and followed by secondary changes.

(3) Central retinal dystrophy: theoretically the central retinal dystrophies might show several subvarieties: two neuro-epithelial types, in one the rods being involved, in the other the cones; and a type dependent upon changes in the retinal capillaries supplying the central area. On the present material, because of the almost total lack of histological information, this fine subdivision is impossible.

SUMMARY

1. Eight familial groups of macular dystrophy are reported.

2. They illustrate the great range of ophthalmoscopic appearances, extending from fine mottling of the maculæ to "exudative" reactions, "inverse retinitis pigmentosa," intense central pigmentary changes, hole formation, extensive perimacular involvement, and the patterned reaction of Doyne's choroiditis.

3. Symptomatically, macular dystrophy has an equally wide range. The symptoms may be so severe as to constitute total day blindness (total color blindness) or so mild that vision is hardly affected. The condition is not necessarily rapidly and relentlessly progressive.

4. On the basis of these cases, supported by an analysis of the material recorded in the literature, it is held that Best's congenital macular degeneration, Doyne's choroiditis, Stargardt's disease, and the numerous types of central macular dystrophy described by different observers constitute a single clinical entity with more than one mode of inheritance.

5. This central retinal dystrophy must be distinguished from central internal limiting membrane dystrophy (angioid streaks).

LESLIE L. MCCOY, M.D.

Puntenney, I.: The Effect of Stimuli on the Caliber of the Retinal Blood Vessels. *Am. J. Ophth.*, 1940, 23: 1113.

In this article the author presents (1) a discussion of methods for photographing the retinal blood vessels in man, (2) a description of the Kukan ophthalmodynamometer, which has been used experimentally for lowering the intra-ocular tension, and (3) new photographic evidence with the following findings:

1. The inhalation of amyl nitrite produced dilatation of the veins in 2 of 22 patients and a slight dilatation of the arteries in 1.

2. Intra-ocular pressure reduced with the Kukan apparatus produced an increase in the caliber of the veins in 8 of 10 patients with a slight increase in the caliber of the arteries in 3.

3. Injections of mecholyl produced a dilatation of the veins in 3 of 8 patients with a questionable dilatation of the arteries in 1.

4. No increase in the caliber of the vessels was observed after nembutal and cold pressor tests.

5. One patient photographed during hyperpyrexia treatment showed a questionable dilatation of the veins.

The value of entoptoscopy in determining functional narrowing of the capillaries is also discussed by the author. He recommends the Kukan ophthalmodynamometer for massage during treatment following occlusion of the central artery.

LESLIE L. MCCOY, M.D.

EAR

Mitchell, H. E.: Tumors of the External Auditory Canal, with a Report of 11 Cases. *Arch. Otolaryngol.*, 1940, 32: 831.

The author reviews 11 cases of tumor of the external auditory canal from Cleveland City Hospital and Lakeside Hospital. In this series, there were only 3 cases of malignant tumor. In all of these the lesion was squamous carcinoma; 1 patient was a white woman, 1 a Negro, and the other a white man.

Two cases of pathologically benign but locally recurrent tumor are perhaps the most interesting from the clinical point of view. One tumor was of a cylindromatous lymphangioma, in a Negro woman. No other case of this type has ever been reported in the literature. The other tumor was a persistent keloid formation which blocked the external auditory canal. The patient in this case also was a Negro woman.

One case of a benign ulcer resembling a malignant lesion is described.

Five cases of osteoma also are included.

The recent literature on tumors of the external auditory canal is reviewed.

JAMES C. BRASWELL, M.D.

MOUTH

Mead, S. V.: The Control of Hemorrhage. *Am. J. Orthodont. & Oral Surg.*, 1940, 26: 982.

The causes of hemorrhage are trauma, surgical operations, irritation by foreign bodies and loose bone, sepsis, periodontal disease, invasion of malignant growths, as well as certain constitutional disorders. The types of hemorrhage which are likely to prove most troublesome after operation occur in hemophiliacs, or congenital bleeders, in patients who have lowered resistance from infection and diseases of the blood, and persons having high blood pressure. According to the vessel involved, hemorrhage may be arterial, venous, or capillary.

Classified according to time, a primary hemorrhage is one which occurs at the time of injury; an intermediate hemorrhage, one which occurs within twenty-four hours after the cessation of the primary hemorrhage; and a secondary hemorrhage is one which occurs after twenty-four hours. Classified according to cause are numerous factors: trauma, ulceration of the vessels, changes in the composition of the blood or elements of the blood, polycythemia, agranulocytosis, pernicious anemia, aplastic anemia, lymphatic and myelogenous leucemia, purpura hemorrhagica, secondary anemia, and hemophilia. In arterial hemorrhage the blood escapes in spurts

and is of a bright red color; in venous hemorrhage the blood is dark and flows steadily; and in capillary hemorrhage there is a general oozing of blood from the surface.

When hemorrhage arises as a difficult problem, a very careful clinical examination should be made, supplemented by a general physical examination and laboratory tests, when necessary, in order to make a correct differential diagnosis. In cases in which there is a systemic disorder, it is desirable to correct any abnormality before surgery. If the bleeding or clotting time is at all abnormally high, an attempt should be made to correct this before surgery. When the patient gives a history of previous bleeding, careful attention to diagnosis and prevention should be carried out. Very little dependence should be placed upon the usual types of remedies, such as calcium lactate, calcium gluconate, gelatin, and many of the proprietary preparations. Compound tannic-acid solution is the best agent for local use in the mouth. There seems to be much merit in the use of citrus fruit and juice to provide Vitamin P, with which to correct capillary fragility. Vitamin K is beneficial in cases of biliary deficiencies and in hemorrhagic diseases of the newborn. Koagmin, too, has proved beneficial. The one great method upon which all surgeons depend is transfusion. This is usually a postoperative measure, but in extreme cases may be used as a pre-operative measure.

NOAH D. FABRICANT, M.D.

NECK

Albright, H. L.: Severe Hemorrhage from the Head and Neck. *New England J. Med.*, 1940, 223: 532.

In the majority of even severe hemorrhages, adequate control may be gained by the use of a hemostat, ligature, pressure, or packing. Occasionally additional measures may become urgently necessary in order to control hemorrhage from intra-oral cancer and deep lacerations of the head and neck, especially stab and bullet wounds.

Although in many cases massive hemorrhage from the mouth may rapidly become fatal, methods of quick, orderly approach, such as immediate intra-oral and extra-oral manual pressure, tracheotomy followed by gauze packing of the pharynx and, later, by proximal ligation of the affected vessel, may help in controlling the emergency and in eventually saving the patient's life. Likewise, deep lacerations, such as stab and bullet wounds may require any or all these measures to control the hemorrhage.

Injury in the region of the retroparotid space is very likely to sever the last four cranial nerves—glossopharyngeal, vagus, spinal accessory, and hypoglossal—and the cervical sympathetic trunk. This gives rise to characteristic changes described by Villaret in 1917 as the syndrome of the retroparotid space.

The characteristics of this syndrome are easily recognizable, seriously damaging, and usually permanent. They are summarized as follows:

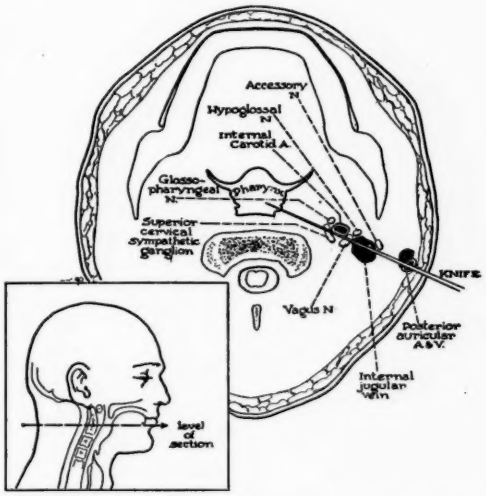

Fig. 1. This sketch shows the level of injury (insert) and a cross-section study. The path of the knife blade traverses the retroparotid space. Note the closeness of the uninjured internal carotid artery to the other structures severed, namely, the posterior auricular artery and vein, internal jugular vein, last four cranial nerves, and cervical sympathetic ganglion.

TABLE I.—POSSIBLE RESULTS OF NERVE INJURY IN THE RETROPAROTID SPACE

Results	Nerve involved
Loss of taste on posterior third of tongue Deviation of dorsal wall of pharynx to sound side Loss of sensation in pharynx, palate and fauces Loss of sensation on dorsal wall of external auditory meatus of ear	Glossopharyngeal (ninth cranial) nerve
Paralysis of vocal cord and palate on side of injury, with hoarseness and dysphonia Difficulty in swallowing and eating, with regurgitation of fluids into nasopharynx	Superior laryngeal or inferior recurrent laryngeal (vagus-tenth cranial) nerve
Inability to raise arm due to paralysis of trapezius muscle, causing a winged scapula deformity	Spinal accessory (eleventh cranial) nerve
Paralysis and atrophy of one side of tongue, with deviation to the injured side	Hypoglossal (twelfth cranial) nerve
Enophthalmos, narrowing of palpebral fissure, miosis and numbness of side of face—Horner's syndrome on side of injury	Cervical sympathetic nerve trunk

Control of such massive hemorrhage and recognition of those extracranial nerve injuries are illustrated in the case operated on by the author. The

patient was a man who was severely stabbed with a flat-bladed knife in the upper right posterior side of the neck. Profuse hemorrhage was first controlled by pressure, then by three deep silk sutures through skin and subcutaneous tissues. Secondary hemorrhage occurred the next day following coughing. Examination confirmed the suspicion that the posterior pharyngeal wall had been pierced just above the level of the soft palate. There was paralysis of the right vocal cord and a low husky pitch to the voice with thickened speech, difficulty in swallowing, and nasal regurgitation. Operation was carried out under novocaine anesthesia. After removal of the clot, generous enlargement of the incision, and retraction of the deep fascial layers, exploration revealed extensive deep tissue injury, undoubtedly reaching the pharynx. The terrific bleeding defied exposure and control, so the wound was tightly packed. The patient was turned on his left side, and under novocaine infiltration a 5-cm. incision was made along the anterior border of the right sternomastoid muscle in the upper third of the neck. The bifurcation of the common carotid artery was clearly exposed, and the external carotid artery was doubly ligated with No. 1 chromic catgut above and below its first branch, the superior thyroid artery; hereby the possibility of a collateral blood flow from the opposite side of the neck was cut off. The wound was closed in layers. The original wound was then inspected after removal of the gauze pack, and hemorrhage reappeared, although with less force. It appeared to be coming from the internal jugular vein at the base of the skull; the bleeding from the posterior auricular and occipital arteries was probably removed. The wound was tightly repacked. The patient recovered.

Seven weeks later, the patient was well except for difficulty in swallowing, with the food threatening to go down the trachea. There was hoarseness with a lowered pitch of the voice, and almost daily morning headaches. In addition, he presented a right Horner's syndrome and weakness of the entire right side of the face.

Eleven months later, by which time the author's perusal of the literature had drawn his attention to Villaret's syndrome of the retroparotid space, the patient was seen again and noted to have all the evidences of complete extracranial division of the glossopharyngeal, vagus, spinal accessory, and hypoglossal nerves, and partial recovery from injury to the sympathetic nerves.

In this case, ligation of the external carotid artery diminished but did not in any manner control the hemorrhage. The persistent non-arterial bleeding suggested severance of the internal jugular vein at a level close to the base of the skull, just below its emergence from the jugular foramen. The sketch (Figure 1) allows clear visualization of the path of the flat-bladed knife through the deep retroparotid space to the nasopharynx.

The author suggests that ligation of the internal carotid artery should be done only when it is urgently necessary, for complications occur. The artery in most cases should be ligated just distally to its first branch, the superior thyroid artery, in order to prevent thrombosis from extending to the internal carotid artery, and to eliminate collateral blood flow from the opposite side via the superior thyroid artery. SAMUEL H. KLEIN, M.D.

Saegesser, M.: Malignant Goiter (Die Struma maligna). *Monatsschr. f. Krebsbekampf.*, 1940, 8: 217.

Eighty per cent of malignant strumas develop from a nodular goiter. The frequency of malignant goiters is greater in endemic regions than in regions where the goiter develops only sporadically. The so-called cystadenoma papilliferum is independent of the thyroid gland and originates from germinal tissue of branchial clefts.

Various types of malignant goiter have four characteristic signs in common: (1) rapid growth, (2) increased consistency, (3) diminished mobility on palpation or deglutition, and (4) tuberous surface. Pains radiating to the shoulders or occipital region are suspicious while an involvement of the recurrent nerve, leading to hoarseness and paralysis of the sympathetic nerves with Horner's signs are rarely significant. The general condition is not necessarily affected in early stages and functional disturbances of the thyroid gland are exceptional. As a rule, metastases appear only in advanced stages but roentgenograms of the lungs are always advisable. It is important to differentiate a malignant goiter from an old hemorrhagic cyst which may simulate a neoplastic disease. A diminishing size of the tumefaction speaks in favor of hemorrhage. Thyroiditis; strumitis, with or without suppuration; tuberculosis; and syphilis may complicate the picture.

The best method of treatment is surgical, followed by irradiation. The author is opposed to exclusive radium and x-ray treatment. The internal jugular vein may be sacrificed on one side, if necessary, but in adults the carotid artery should not be ligated. Two containers, each with from 10 to 20 mgm. of radium and with a 2 mm. platinum filter, wrapped in rubber, are placed into the wound for two days. Six weeks later from 40 to 60 mgm. of radium are placed over the involved region at a distance of 3 cm. from the skin for from four to six days.

The average life expectancy is 3.77 years if a proliferating struma is present; the figures are 2.4 years for the endothelial type, 2 years for carcinoma, and 0.85 years for a sarcoma.

(EGGERT). JOSEPH K. NARAT M.D.

Portmann, G.: Total Laryngectomy in Three Stages (La laryngectomie totale en trois temps). *Presse méd.*, Par., 1940, 48: 633.

Total laryngectomy is the only effective operation in cancer of the larynx. The mortality of this operation has been very high because of postoperative lung complications. Gangrene of the operative wound often occurred on the fifth or sixth day after

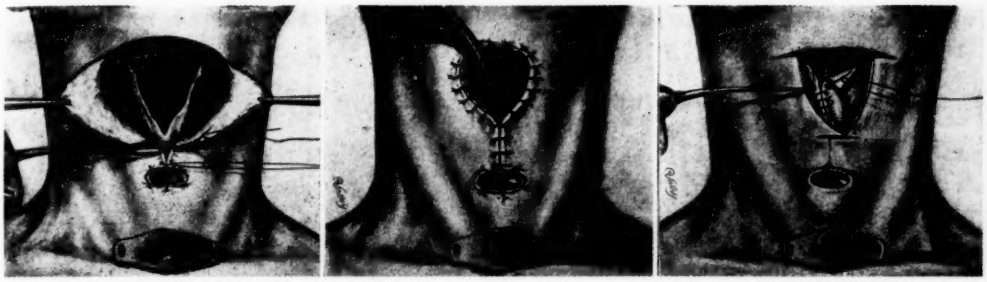

Fig. 1. Fig. 2. Fig. 3.

Fig. 1. The larynx has been removed and the upper end of the trachea sutured to the skin.

Fig. 2. The mucous membrane of the pharynx has been sutured to the skin; the feeding tube is passed through the opening; and a dressing separates this wound completely from the tracheotomy opening below.

Fig. 3. A plastic operation is performed, after the feeding tube has been removed and passed through the nose. The mucous membrane is sutured with catgut and the skin with horsehair.

operation and this was followed a few days later by pneumonia.

The author tried various methods of avoiding this complication without success until he finally devised a method of operation which prevented the lung complication. He isolated the respiratory opening in the trachea from the operative wound through which the larynx was removed. The first stage of the operation is the performance of a tracheotomy just above the end of the sternum. The interval of two weeks between this and the laryngectomy permits of healing of the tracheotomy wound and the establishment of regular respiration through the tracheotomy so that the lungs are less vulnerable when the main operation is performed. The second or main stage of the operation is the total removal of the larynx through a pharyngostomy opening. Hemostasis is assured by suture of all the vessels that might bleed secondarily. Then the mucous membrane of the upper end of the trachea and that of the pharynx is sutured to the skin. The feeding tube is passed through the pharyngostomy opening and a heavy dressing placed over this wound so that the tracheotomy opening through which the patient breathes is separated by a considerable stretch of normal skin from the upper opening into the digestive tract. Some two months later a plastic operation is performed for the closing of the pharyngostomy. The tracheotomy opening frequently closes spontaneously; if it does not it can be closed by a plastic operation also.

The advantages of the operation are: (1) it prevents infection of the respiratory tract from the laryngectomy wound; (2) the operation is much shorter than the old one, as it can be performed in forty-five minutes instead of from an hour and three-quarters to two hours; (3) the patient is less shocked because of the brevity of the operation and the minimum of toxic absorption. The patient can generally be out of bed in two or three days. In the 34 cases that have been operated on in this way in the six years since the introduction of the method there has been no operative mortality.

AUDREY G. MORGAN, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Thorner, M. W., Field, R., and Lewy, F. H.: The Effects of Repeated Anoxia on the Brain. *J. Am. M. Ass.*, 1940, 115: 1595.

This study of the effects of repeated anoxia on the brain is particularly timely, because of the repeated anoxia suffered by aviators at high altitude, and with this in mind it was undertaken at Randolph Field, Texas. The object was to determine the histological changes in the brain following specific periods of anoxia. The animals used were guinea pigs and cats. They were placed in glass containers so that they could be observed during the period of anoxia, and the anoxia was produced by immersion in nitrogen. The usual objection that the circulation was impaired during the anoxic period was avoided in this series of experiments. The animals were placed in five groups:

Group 1. Animals rendered anoxic for various periods of time and decapitated within one-half hour of removal from the chamber.

Group 2. Animals killed in nitrogen directly with no recovery period.

Group 3. Animals killed in nitrogen following repeated sublethal exposures on different days.

Group 4. Animals dying hours after nitrogen immersion.

Group 5. Animals decapitated after repeated anoxia.

From the experiments the author concludes that exposure to sublethal periods of anoxia led to vascular and degenerative changes in the brains of guinea pigs and cats. Some of these changes were irreversible and became summated in animals repeatedly subjected to anoxia.

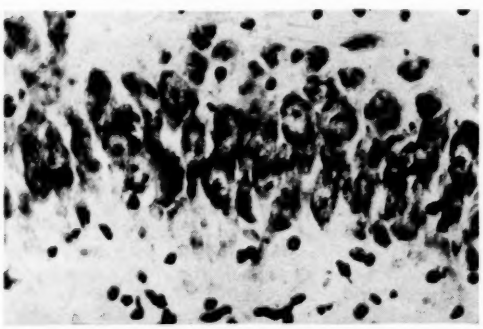

Fig. 1. Section of fascia dentata of Ammon's horn of the animal decapitated after having been immersed in nitrogen for fifteen seconds, showing normal architecture and appearance of cells. (Cresyl violet stain; reduced from a photomicrograph with a magnification of 550 diameters.)

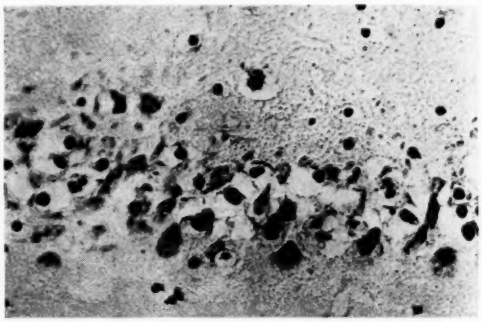

Fig. 2. Section of fascia dentata of Ammon's horn of the animal that died forty-eight hours after the last of twenty-four exposures to nitrogen, showing ischemic cell necrosis. (Cresyl violet stain; reduced from a photomicrograph with a magnification of 550 diameters.)

These results cannot be directly correlated with anoxia in man, but inferences may be drawn. At the same time the experiments suggest that individuals exposed repeatedly to low oxygen tension will have a gradual lowering of cerebral reserve and may eventually develop a condition similar to that of the punch-drunk boxer. Illustrations of the degenerative changes in the brain as revealed by the microscope are provided. ADRIEN VERBRUGGHEN, M.D.

Koskoff, Y. D., Markson, V., and Wall, N. M.: A Method for the Removal of Areas of Brain Following Freezing *in Situ*. *Am. J. Surg.*, 1940, 50: 271.

An ingenious double-cylinder apparatus to be used with liquid nitrogen is described as a means of removing cortical blocks after freezing *in situ*. It has been used experimentally on cats, in which the authors found that clean sections could be made with a minimum of hemorrhage and trauma. The method is described for experimental use, but it indicates that the instrument may be adaptable to certain uses in neurological surgery on the human brain, as in the removal of tumors.

JOHN MARTIN, M.D.

Raney, R. B., and Raney, A. A.: Trigeminal Neuralgia with Demonstrable Gross Causative Lesions. Report of 5 Cases. *Am. J. Surg.*, 1940, 50: 227.

It is agreed by the authors that it is frequently unwise to section the posterior root of the trigeminal nerve when trigeminal pain is not typically that of true major trigeminal neuralgia with the classical type of pain, trigger zone, and absence of other neurological signs. However, they point out that although the trigger zone may be lacking in some of the atypical neuralgias, the pain may be very much

the same as that of tic douloureux, and that definite organic cause for such pain can often be demonstrated and removed by surgery. They cite 5 such cases of their own; the findings were (1) adhesions about the ganglion and root following severe craniocerebral injury; (2) anomalous varix of the petrosal sinus; (3) calcified acoustic neurinoma; (4) chronic inflammatory process involving the dura, ganglion, and root; and (5) small, encapsulated acoustic neurinoma. The patient with the varix was freed of pain by coagulation of the vessels, and the removal of the small encapsulated acoustic neurinoma brought relief to the patient who was afflicted therewith, without sacrifice of the posterior root. In the 3 remaining cases, the root was sectioned and relief from the intractable pain was subsequently obtained in all three patients.

In such cases of atypical neuralgia in which surgery may be expected to offer relief, the distress usually follows the course of one or more branches of the nerve, and other neurological signs may be present. Likewise, there may be roentgenological evidence of a local lesion, or there may be a history of local trauma. JOHN MARTIN, M.D.

SPINAL CORD AND ITS COVERINGS

Mixter, W. J., and Barr, J. S.: Protrusion of the Lower Lumbar Intervertebral Discs. *New England J. Med.*, 1940, 223: 523.

Although the protrusion of an intervertebral disc may occur at any level, by far the most common site is either between L_4 and L_5 or L_5 and S_1. In such a location the rupture frequently occurs at the side of the vertebral canal and impinges on the fifth lumbar or the first sacral nerve root. The clinical entity will then be a constant one. Definite sciatic pain, diminution or loss of the Achilles reflex, difficulty in raising the straightened leg, and an elevation of the total protein content of the cerebrospinal fluid are the most common findings.

The authors believe that symptoms must be definite to warrant operation, and though they point out the disadvantages of lipiodol, they never hesitate to use it when a diagnosis is not certain after ordinary examination. They believe that preliminary orthopedic care should be tried and that "no patient should be investigated as a suspected case unless his symptoms have been severe and disabling and have persisted for months rather than weeks."

After accurate localization, they remove the protruding mass by rongeuring away only the lower edge of the lamina above and the upper edge of the lamina below. Removal is always extradural, when possible, but the dura is always opened for the removal of lipiodol when such a substance has been used. Among 77 cases of verified protruded disc, followed up for more than one year, 80 per cent of the patients have been cured; results have been fair in 10 per cent of the patients, and the remaining 10 per cent were found to be unrelieved.

JOHN MARTIN, M.D.

PERIPHERAL NERVES

Nageotte, J.: Can We Improve the Treatment of Wounds of the Peripheral Nerves? (Peut-on améliorer le traitement des blessures des nerfs périphériques?). *L'Union médicale du Canada*, 1940, 69: 1046.

In numerous experiments on animals, Nageotte has studied the function of nerve grafts and the types of graft that give the best results in injuries to the peripheral nerves. The graft he has found takes no part in the regeneration of the nerve except to serve as a framework for the advance of the regenerating nerve fibrils. The best type of tissue from the nature of its structure for this purpose is nerve tissue. This has been demonstrated in many animal experiments. An illustrative experiment is reported in which a section of 4 cm. was resected from both sciatic nerves of a dog; on one side the sciatic nerve of a rabbit fixed in alcohol was used as a graft to repair the defect; on the other side a portion of a vein fixed in formol was employed as a graft. The animal was killed a year later, but in the meantime it had regained the use of the hind legs on both sides. On the side of the nerve-tissue graft, the muscles of the leg were entirely normal in size and development; in the area of the graft the sciatic nerve was normal in structure except that it was smaller in diameter (the size of the sciatic nerve of a rabbit). On the side of the vascular graft, although the functional results had been satisfactory, the muscles were less well developed than on the other side; the area of nerve graft was irregular and the nerve fibrils did not show their normal regular arrangement and there was some abnormal fibrous tissue in the graft. During life the animal had shown signs of pain in three toes of the foot (trophic disturbances). From these findings the author concludes that in the repair of traumatic defects in peripheral nerves, nerve tissue should be used for the grafts. This nerve tissue may be taken from any species of animal, but it should have only a slight collagenous stroma.

The method of suture is also important in the repair of peripheral nerve injuries; it is not necessary to suture the graft tightly in place, it need only be held in contact with the nerve for the short period before the physiological processes of repair are established. Sutures should be placed at a few points only, and care should be taken not to injure the nerve fibrils. In his experiments on dogs the author has used only two suture points at each end of the graft, employing very fine silk passed through the nerve sheath; the knots are not tied tightly, just sufficiently to bring the surfaces into contact without pressure. Occasionally a third suture may be used if there is any tendency toward displacement of the graft. The graft should be sufficiently long so that no traction will be exerted on it in any position of the extremity involved. In about 150 dogs in which nerve graft operations had been done on both sides, there has been only one instance of disunion, and this was due to faulty technique. The author main-

tains that if the methods of nerve repair used in these experiments are applied in clinical practice they will improve the results obtained in peripheral-nerve injuries. ALICE M. MEYERS.

Kosténetzkey, A. S.: Morphological Changes in Nerves of the Anterior Extremities in Laboratory Animals After Experimental Ischemia. *Vestnik khir.*, 1940, 59: 555.

Numerous physiologists emphasize the stability of nerves in the presence of a disturbed blood supply, but such observations are not in accord with the morphological findings. Trophic lesions in animals after a complete severing of the nerve trunks in the anterior extremities are rare. Clinical observations demonstrate the gravity of pathological processes in the lower extremities in man under the influence of a prolonged disturbance of the peripheral circulation of the blood, while such sequelæ are relatively rare in the upper extremities.

In 8 rabbits, 5 rats, and 7 frogs under ether anesthesia the author cut the left subclavian artery between two ligatures, 0.5 c.cm. distal to the origin of the vertebral artery. No disturbance of the function of the involved extremity followed. The period of observation was fifteen days in the rabbits and rats, and from sixty to seventy-five days in the frogs. No histopathological changes could be detected in the corresponding peripheral nerves in the rabbits and rats twenty-four hours after the ligation of the artery. After from thirteen to fifteen days the nerve trunks of the rabbits' arms still remained intact but in the forearms signs of a periaxial process appeared, and several nerve fibers showed symptoms of wallerian degeneration. Dilated blood vessels with intensely stained endothelial nuclei were visible in the perineural spaces. In some fibers myelin globules, deeply stained with osmic acid, were visible. In Nissl's specimens the author found hypertrophied Schwann's cells, with deeply stained nuclei and vacuoles in the protoplasm, while in the perineural spaces a proliferation of fibroblasts was noticed.

A similar pathological process with signs of degeneration but with a more rapid evolution was observed in the rats. All the changes were confined to the nerves of the forearm. The nerve trunks in a large number of nerve bundles were filled with granular cells. Not only was the cycle of evolution of degenerative changes accelerated in the rats as compared with the rabbits but also the stage of restitution was usually reached much earlier.

In specimens impregnated with silver, no changes in the axial cylinders of the nerve fibers could be detected in the anterior extremities of the rats or rabbits. Intra vitam no motor, sensory, or trophic disturbances could be found.

A comparison of the author's findings in the anterior extremities of the animals with the findings of other authors in posterior extremities shows a lesser intensity of pathological changes in the nerve parenchyma and the vasculomesenchymal apparatus in the front legs, although the character of the changes was identical.

A digital compression of the main artery supplying an extremity causes a much less severe trauma of the peripheral nerves than the application of a tourniquet. JOSEPH K. NARAT, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Adair, F. E.: A Consideration of Recent Additions to Clinical and Experimental Knowledge of Breast Conditions. *West. J. Surg., Obst. & Gynec.*, 1940, 48: 645.

The author states that he is not discussing problems relative to the breast on which there is general agreement but is considering those problems which today are leading to the greatest differences of opinion.

In cases of maldevelopment of the breast in which the breasts develop unequally, surgery is definitely contraindicated. Periodic examinations should be made and if glandular therapy is used to hasten development, it is best to wait until the establishment of normal menstruation. Either subcutaneous injections of an estrogenic substance may then be used or, preferably, the local use of an ointment containing estrogenic substance may be resorted to.

Gynecomastia is not easily confused with carcinoma of the male breast but may be diagnosed when the true lesion is mastitis. The majority of cases of gynecomastia respond to treatment with testosterone propionate. Mastitis of the male breast is more common than cancer. Hot compresses and "scientific neglect" are the best treatment. The trouble usually subsides in several months.

Painful breasts in the female should not be treated by estrogenic substances: first, because the painful breast is the fibrous or adenomatoid type not relieved by such injections, and second because the administration of large amounts of estrogenic substances increases, in all probability, the hazard of cancer development. Painful breasts are far more prevalent in thin women with no subcutaneous fat. Occasionally x-ray therapy will give relief to the patient with very large painful breasts. In the average case the cure is, first, reassurance; second, hot compresses or warm showers over the shoulder, breast, and chest wall of the affected side; and third, the acquiring of a thicker layer of adipose tissue.

Simple cysts and cystic disease do not include cysts containing papillomatous growth. The last usually develop in the years immediately preceding the menopause. In a series studied by the author, all occurred between the ages of thirty-seven and fifty-two years. Rarely does such a condition exist in the late twenties or early thirties. After a diagnosis has been established, one or two injections of from 10,000 to 15,000 international units of estrogenic substance greatly improve the condition for a month or several months. The author does not believe these cysts are precancerous.

The author discusses two lesions of the breast which he believes to be precancerous, the papillary cystadenoma and the localized hyperplastic or adenomastoid mastitis. The papillary cystadenoma is localized to one duct beneath the edge of the areola. Pressure on the nodule produces a sanguineous or serosanguineous discharge from only one nipple. Here transillumination has its greatest value. The blood-filled cyst shows up as a dark shadow. Local excision is adequate if it is done carefully and properly.

A localized mass in hyperplastic or adenomatoid mastitis should be removed as it frequently becomes malignant after the menopause.

It is extremely rare for a fibro-adenoma to become a sarcoma of the breast.

After carefully discussing surgery of the breast and irradiation, the author states that as a result of work done in the past six years he does not use pre-operative radiation if there is no involvement of the axilla on the theory that surgery will probably produce a cure if anything will. However, those operable cases with axillary involvement are given heavy pre-operative irradiation because they are always desperate cases.

The indications for pre-operative irradiation in operable breast cancer are given as follows: (1) pregnancy; (2) young women in their twenties and thirties; (3) all cases with axillary involvement; (4) diffuse disease of the breast, such as comedocarcinoma or diffuse duct carcinoma; (5) all cases with multiple sites of cancer located in the same breast; (6) all cases with invasion of the skin of the breast or with skin nodules; and (7) inflammatory carcinoma located just in the center of the breast; otherwise inflammatory carcinoma is a totally inoperable disease.

The contraindications to pre-operative irradiation are: (1) colloid carcinoma, as it is completely radio-resistant; (2) the aged who do not well withstand daily trips to the hospital for irradiation; and (3) patients with cardiac disease to whom it is necessary to give intense irradiation directly over the cardiac area.

The unfortunate sequelæ of pre-operative irradiation are: (1) with heavy irradiation above 1,800 roentgens per portal, the possibility of lung fibrosis; (2) coughing; (3) pain through the chest; (4) a swinging of the mediastinum and of the heart to the side radiated; (5) dyspnea; (6) anemia; (7) poor wound healing; (8) fibrosis of the muscles, tendons, and fasciæ about the shoulder with marked restriction of motion; and (9) a much larger number of lymph-edematous arms. EARL O. LATIMER, M.D.

Wirth, K., and Peters, M.: A Contribution to the Subject of Roentgen Treatment of Early Mastitis in the Puerperium (Beitrag zur Roentgenbehandlung der puerperalen Fruehmastitis). *Muenchen med. Wchnschr.*, 1939, 1: 59.

Following a brief consideration of the methods used for years in the treatment of early infiltrative mastitis (moist dressings, alpine-lamp radiation,

diathermy, sollux radiation, salves, parenteral protein-therapy, ice, Bier's suction) the author discusses the roentgen therapy of puerperal mastitis. This consists of a counter-inflammatory irradiation, so-called "Roentgenschwachbestrahlung" (roentgen-mild-irradiation), or "RSB," which is administered within forty-eight hours of the appearance of the first symptoms.

The author has had 31 cases of mastitis under observation in one and a half years, whereof 7, already abscessed, were treated operatively. Eight of the patients had received the customary treatment—elevation and binding of the breast, emptying by pump, and the application of ice-bags. Of these conservatively treated patients, who served as controls for the patients treated by irradiation, 6 were discharged as cured and 2 developed abscess and had to be incised. The remaining 16 patients were given roentgen irradiation. Twelve of these were cured and the rest had to undergo some form of surgical treatment. This, however, together with the preceding irradiation, resulted in grave complications. Two extensive, and 2 abbreviated case histories of the 4 patients with complications are appended. In the first case, following two irradiation treatments which had been administered to a new area of infiltration in the lower outer quadrant three weeks after incision of the original area in the upper quadrants, a chronic inflammatory edema spread slowly over the entire breast; this made treatment extremely difficult and markedly prolonged the course of the disease. In the second patient the process, in spite of the irradiations, went on to abscess and had to be incised. Following this a chronic inflammatory edema appeared and spread over the entire breast. In addition to this, on the fifth day after the incision, an erysipelas, which took origin from the area of the incision, developed. In the third patient of this group an abscess developed in spite of the immediate roentgen-ray treatments which were given in three sittings. Finally, in the fourth patient there developed, following the irradiation, a chronic inflammatory infiltration which was only slowly resorbed following treatment over a period of months.

The author comes to the following conclusions: Roentgen treatment promises little in deeply situated infiltrations and nodulations, and in interstitial mastitis; as a fact it may do harm by leading to a more intense necrosis of the tissue than that which follows the usual methods of combating the condition. Of course, the results are more favorable in the cases of superficial, parenchymatous mastitis, in which early application of the roentgen therapy will often abort the course of the inflammation completely. Advantages of this form of roentgen therapy lie in the rapid disappearance of pain with retention of the ability to suckle, while the remaining inflammatory manifestations are favorably influenced. In the authors' opinion, however, the usual methods in this connection are not much inferior to roentgen irradiation. (H. Breuer). John W. Brennan, M.D.

Devenish, E. A., and Jessop, W. H. G.: The Nature and Cause of Swelling of the Upper Limb After Radical Mastectomy. *Brit. J. Surg.*, 1940, 28: 222.

Evidence of the nature of the swelling of the upper limb after mastectomy was obtained by three different methods: namely, clinical observation, roentgenographic study, and study after the injection of the skin lymphatics with dye.

Clinical observation showed that the swelling was always of two kinds, one pitting, the other not pitting. The usual assumption that pitting indicates the presence of edema fluid was supported by observation of the shrinkage which occurred with continuous suspension of the limb.

There was no evidence of venous obstruction in the cases investigated. Increased venous pressure occurring during exercise is a contributing factor to the swelling only in the presence of lymphatic obstruction.

Postoperative lymph flow as investigated by means of the injection of the skin with dye showed that the flow may be unaltered, diminished, or stopped. Lymphatic obstruction alone is sufficient to cause swelling. Neither wound sepsis, recurrent attacks of inflammation in the limb, nor deep x-ray therapy is necessary for its development or persistence.

The infrequent development of swelling following a standardized operation may be due to variations in the extent to which the main lymphatic trunks draining the upper limb are excised.

The delayed onset of swelling which in 1 case was as late as sixteen years following operation may be due to a combination of partial lymphatic obstruction and loss of skin elasticity.

Preservation of the main lymphatic trunks by leaving a sufficient thickness of subcutaneous tissue on the upper axillary flap should decrease the incidence of the complication.

Norman C. Bullock, M.D.

TRACHEA, LUNGS, AND PLEURA

Blades, B.: Emergency Treatment of Traumatic Chest Injuries. *Surg. Clin. North Am.*, 1940, 20: 1473.

It is pointed out that war and automobiles account for the great majority of traumatic wounds of the chest. The emergency treatments of these traumatic chest injuries are discussed with regard to shock and means of counteracting the shock. It is stressed that immobilization by strapping the chest is beneficial in affording relief, but this relief depends upon the adequate immobilization of the entire bony thoracic cage. By far the most common injury in nonpenetrating wounds of the chest is fracture of one or more ribs, and the pain and shock associated with this condition may mask serious intrathoracic damage.

In younger people it is possible to sustain severe intrathoracic injury without evidence of rib fractures. In adults the bones become brittle and a rela-

tively slight injury may cause fracture of the ribs. The seriousness of the chest injury cannot be gauged by apparent injury of the chest wall, but can only be estimated by the amount of damage which has been done to the underlying intrathoracic organs. The most common complications of chest injuries are hemothorax, pneumothorax, and subcutaneous emphysema. The author discusses the attitudes toward therapy and points out that conservatism is usually the safest.

The emergency treatment of penetrating wounds of the chest is more difficult and less satisfactory than that of non-penetrating injuries. The first and most important consideration is to close the defect in the chest wall as well as possible under the existing circumstances, either by suture or by compression bandage.

The author discusses the complications of traumatic chest injuries with regard to injuries to the blood vessels, traumatic diaphragmatic hernia, and wounds of the heart. He gives the physical findings which indicate the presence of one of these complications, and stresses the importance of recognizing them early. Late complications of traumatic chest injuries are relatively rare. Empyema may follow hemothorax or pneumothorax, and occasionally one sees lung abscesses. PAUL MERRELL, M.D.

Edwards, F. R., and Davies, H. M.: Traumatic Hemothorax; Response of the Pleura to Blood; Treatment; Infected Hemothorax and Foreign Bodies; Re-Expansion of the Lung. *Lancet*, 1940, 239: 673.

Hemothorax complicates 70 per cent of the chest injuries in modern warfare. Injury to a main blood vessel produces death rapidly, but, fortunately, this occurs in only a small number of cases. Bleeding from the lung usually ceases spontaneously because the pressure in the pulmonary vessels is low, the vessels easily retract, and the collapse of the lung collapses the vessels. Bleeding from an intercostal artery or the internal mammary artery is apt to continue and considerable loss of blood occurs.

Two factors are responsible for death—loss of blood and compression. The loss of three pints may cause death, but generally bleeding ceases before that amount is lost. Symptoms of excessive loss of blood should indicate an injury to a large or to a systemic vessel.

Blood has a very irritative effect on the pleura. Thoracoscopy reveals both the visceral and parietal pleura to be reddened and markedly edematous with large areas of acute hyperemia associated with numerous punctate hemorrhages. A number of subendothelial bullæ are seen; these are caused by air getting between the endothelium and endothoracic fascia. Massive clotting of the blood does not occur but fibrin is deposited in shreds on the pleura in large quantities. Organization of the fibrin may be sufficient to prevent reëxpansion of the lung, but, fortunately, not often. This pleural reaction results in the pouring out of serum high in protein content, which fluid, added to the blood, results in massive accumulations severe enough to compress the contralateral lung. Infection occurred in 17 per cent of the cases.

The irritative effect of blood on the pleura results in a considerable rise in temperature. Pyrexia is closely associated with the degree of tension of the hemothorax and usually drops after aspiration. The pyrexia of empyema is usually septic in type and the patients look toxic, but the pyrexia due to blood is maintained on an even keel and the patients are not toxic.

Immediate treatment should be directed to combating shock, and is best accomplished by transfusions of blood or blood substitutes. Open chest wounds should be closed as rapidly as possible. Evidence of injury to an intercostal or to the internal mammary artery should justify exploration of the wound to ligate the vessel.

Pulmonary bleeding will usually stop of itself and conservatism should be the keynote of treatment, though very occasionally one may be justified in opening the chest to control serious hemorrhage. Opiates should be administered freely and oxygen given for dyspnea.

Tension within the chest should be relieved by aspiration and replacement with air. Patients should be closely watched for pressure symptoms. If infection supervenes, closed intercostal drainage should be performed, but if many clots are present a rib resection should be done and the clots removed or washed out. The continued treatment is that of empyema.

Foreign bodies in the wound should be removed during the preliminary toilet of the wound; in the pleural cavity they should be left until a later stage; and foreign bodies in the lung should not be removed unless they produce symptoms.

The authors believe that small collections of blood will absorb rapidly and should be left alone. They believe that large collections should be aspirated and replaced with air. Breathing exercises are an important aid in re-expanding the lung.

JULIAN A. MOORE, M.D.

Grimes, A. E.: Lung Abscess. *Kentucky M. J.*, 1940, 38: 430.

In this article, the author has given a complete picture of acute putrid lung abscess. He has shown the poor results of conservative treatment and the good results of early surgical drainage. He maintains that most cases are the result of the aspiration of infected material into the smaller bronchi, that most abscesses are peripheral in their location, and that most of them are covered with protective pleural adhesions.

Accurate localization can be accomplished by means of anteroposterior and lateral roentgenograms and bronchoscopy. With accurate localization, external drainage can be done in one or two stages. The author has pointed out that the recent surgical experience of several capable surgeons has

shown that surgical drainage of lung abscess within the first six weeks of its course has greatly reduced the morbidity and mortality of this disease.

JULIAN A. MOORE, M.D.

Rolland, J., and Tsoutis, N.: A Contribution to the Study of the Surgical Treatment of Pulmonary Abscess (Contribution à l'étude du traitement chirurgical des abcès pulmonaires). *Presse méd.*, Par., 1940, 48: 705.

Rolland and Tsoutis note that while pulmonary abscess is usually a serious condition, spontaneous healing may occur, and surgical treatment should not be undertaken before sufficient time has elapsed to show a tendency toward healing. On the other hand, surgical treatment when indicated should not be too long delayed or complications will develop. A diminution in the size of the original lesion may occur, only to be followed by a relapse and the appearance of another lesion of a more serious character, or multiple lesions. It is difficult to formulate any definite rule that is applicable in all cases with regard to the best time for surgical intervention in pulmonary abscess. In the majority of cases a delay of two months, as suggested by Sergent and his associates, may be allowed. However, in some cases, the condition is too serious to permit surgery to be delayed so long.

When surgery is indicated, it is most important to determine the exact location of the abscess by roentgenological study; the authors have found the fluoroscopic examination of the greatest value for this purpose. A final roentgenological examination should be made immediately before operation. The first step in the operation for pulmonary abscess is to determine whether or not the pleura is freely movable or whether adhesions are present. This is done with the use of a trocar, with a technique very similar to that used for artificial pneumothorax except that no air is injected into the pleural cavity. As the trocar is introduced into this cavity, the manometer shows definite oscillations if the pleura is free. If this is the case, adhesions must be created by the injection of a substance such as quinine urethane, or dilute tincture of iodine. There is pain at first, but this rapidly subsides, and within a few days adhesions have formed without any pleural effusion. If pleural adhesions are present, this procedure is not necessary.

When pleural adhesions are present, or have been created, and the general condition of the patient is good, rib resection can be done, and the abscess cavity can be opened, emptied, and disinfected. If the patient shows evidence of toxemia, a less extensive resection may be done, and drainage of the abscess should be instituted; if the patient's condition is very poor, a simple incision with the introduction of an opaque drainage tube into the abscess with the aid of a trocar is sufficient. With such methods of drainage the infection and toxemia are diminished, and when the patient's condition has improved, a more extensive operative procedure can be carried out to obliterate the abscess cavity completely. For this purpose electrocoagulation or the electric cutting current is employed. This same method is employed whether simple abscess or pyosclerosis is present.

The production of pleural adhesions as a preliminary step in the surgical treatment of pulmonary abscess, the authors believe, protects the pleural cavity from infection and greatly improves the prognosis. A similar measure, they suggest, might be used in lobectomy with definite improvement in the results of this procedure. ALICE M. MEYERS

HEART AND PERICARDIUM

Beck, C. S.: Extrinsic Lesions of the Heart. *Texas State J. M.*, 1940, 36: 468.

The heart with an extrinsic lesion is a good organ that has become crippled by some outside factor. Extrinsic heart lesions deserve special consideration because if this outside factor can be removed by operation, the heart again becomes a good organ and the patient can be cured. The author classifies these extrinsic lesions of the heart as follows:

1. *Angulation.* This may be caused by adhesions to the lungs, chest wall, or diaphragm; pneumothorax with dislocation of the mediastinal structures; fluid in a pleural cavity with dislocation of the mediastinal structures; and tumors of the heart, pericardium, and mediastinal structures. It is emphasized that angulating adhesions of the heart are produced by infections that existed outside of the heart, namely, pyogenic or tuberculous infections. The adhesions of rheumatic heart disease, as a rule, are silent and do not cripple the heart. In general, the author believes that operation for cardiac adhesions in the presence of rheumatic heart disease is not indicated.

In experimental studies in the dog, it was shown that in angulation of the heart to either the right or left without displacement of the mediastinum, the arterial pressure falls, the venous pressure rises, and, as a rule, tachycardia appears. These alterations disappear after replacement of the heart to its normal position.

2. *Rotation.* The heart can be rotated in a clockwise or a counter-clockwise direction. This is seen in patients with adhesions, scoliosis, neoplasms, and pneumothorax.

In the experimental animal, rotation of the heart produces a fall in arterial pressure, a rise in venous pressure, and tachycardia. These disturbances are more marked than are those produced by angulation. The author has observed these phenomena in human patients during rotation of the heart for the resection of scars from the posterior surface of the ventricles. This rotation should be given for only a few moments at a time, and ample rest periods are necessary for the recovery of the circulation and the prevention of ventricular fibrillation.

3. *Traction.* It has been established by considerable study in the author's laboratory that traction

on the long axis of the heart is not a factor in extrinsic lesions, and does not disturb the heart. It does not produce dilatation, hypertrophy, or failure of the heart.

4. *Compression.* This may be acute or chronic. Acute compression is always produced by a fluid pressure upon the outside of the heart, the fluid usually being in the pericardial cavity (stab wounds of the heart, purulent pericarditis), although it may be in the mediastinum. A gas under pressure (pressure pneumothorax) may also exert compression upon the heart.

Beck's diagnostic triad for acute compression consists of a rising venous pressure, a falling arterial pressure, and a small quiet heart. An acute compression of about 20 cm. of water usually results in death.

Chronic compression of the heart differs in several ways from acute compression. The venous pressure can rise much higher. The arterial pressure does not fall particularly. The pulse pressure is narrow and not infrequently waxes and wanes with respiration. The heart is always small and atrophic; it cannot dilate nor can it undergo hypertrophy.

The circulating blood volume increases, and the cardiac output per unit of time is reduced. The patient becomes waterlogged, due apparently to the high venous engorgement that accompanies chronic cardiac compression. The lips and nails are cyanotic; the abdomen, thorax, and soft tissues contain free fluid or edema. The heart is quiet, the sounds are distant, and there is no pre-cordial activity.

The various lesions that can produce chronic compression of the heart are pericardial compression scars (not adhesions), blood, pus, transudate or exudate in the pericardial cavity or mediastinal space, tumors of the heart or pericardium, and several other rare conditions. The roentgenological and fluoroscopic examinations are valuable in making a differential diagnosis.

The surgery of compression scars is dramatic in its performance and scarcely less than miraculous in its immediate and remote effects upon the patient. The cure is permanent, and the risk of the operation is not great if the surgeon gives every consideration to his problem. There is no other treatment except operation. SAMUEL H. KLEIN, M.D.

Touroff, A. S. W., and Vesell, H.: Experiences in the Surgical Treatment of Subacute Streptococcus Viridans Endarteritis Complicating Patent Ductus Arteriosus. *J. Thoracic Surg.*, 1940, 10: 59.

Cardiac insufficiency and subacute bacterial endarteritis are the two most serious complications of patent ductus arteriosus. Abbott, from post-mortem examinations, found that 30 per cent of the deaths occurring in cases of this congenital cardiac lesion resulted from the complicating bacterial endarteritis. Only 1 spontaneous recovery has been reported. Until recently patent ductus arteriosus with subacute bacterial endarteritis was treated only by medical means.

The rationale of surgical treatment in cases of infected patent ductus is based upon the observation that ligation or excision of a large venous channel which is the site of an infected feeding focus often proves effective in controlling bacteriemia. The prerequisites for successful surgical eradication of infection would appear to be (1) that the vegetations be confined to the ductus; and (2) that the ductus be of sufficient length to permit excision. If vegetations have extended into the left side of the heart or aorta, operation would seem inadvisable for foci would still discharge into the peripheral circulation despite successful surgery.

The authors working at Beth Israel Hospital in New York attempted obliteration of the patent ductus in 4 cases complicated by subacute bacterial endarteritis. In the first case, although two episodes of minor pulmonary embolization occurred on the fourth and ninth postoperative days, the patient recovered from his bacterial endarteritis. In the second case the patient did not recover from the bacteriemia even though the operation was successful.

In the last 2 cases exsanguination of the patients occurred during the operation as a result of the procedures involving the ductus.

The authors are not discouraged by their high mortality because of the high mortality under medical management. J. DANIEL WILLEMS, M.D.

Armstrong, T. G.: Adherent Pericardium; Constrictive and Non-Constrictive. *Lancet*, 1941, 239: 475.

Adherent pericardium consists of two general types—constrictive and non-constrictive. The author presents evidence to show that the two groups exhibit entirely different histological characteristics, and probably have a different etiology. The density and toughness of the fibrous tissue covering the heart is the deciding factor in producing cardiac compression.

A complete clinical, histological, and pathological study was made in 38 cases. The constrictive group consisted of 10 cases, 6 post mortem, and 4 operative. The non-constrictive group consisted of 28 cases, 20 of which were rheumatic and 8 non-rheumatic. Enlargement of the heart, when present, was invariably associated with rheumatic pancarditis, valvular lesion, or cardiovascular disease. Adherent pericarditis *per se* apparently causes no cardiac enlargement.

The constrictive group presented the following pathological picture:

The pericardium was extremely thick, dense, and tough, sections being composed of an avascular, interlacing system of dense whorls of hyaline fibrous tissue resembling fibrocartilage. The individual fibers were thick, swollen, and structureless, and there was no cellular infiltration. Calcification in the form of nodules, or even plates, was present in 8 of the 10 cases, and there were patches of caseous débris in many places. In 1 instance true bone was

present. No tubercular bacilli or other bacteria were found with special staining methods.

In contrast, in the non-constrictive group the areas of fibrosis were much thinner. There was considerable cellular infiltration, and the collagen fibers were fine, delicate, and wavy. Calcification and caseation were not present.

The non-constrictive type of adherent pericardium probably follows rheumatic pericarditis, but the constrictive type apparently never follows rheumatic inflammation. It is certain that constrictive pericarditis follows tuberculous pericarditis, and it is probable that some cases are the end-result of an often unrecognized septic pericarditis.

LUTHER H. WOLFF, M.D.

ESOPHAGUS AND MEDIASTINUM

Schatzki, R.: The Roentgen Demonstration of Esophageal Varices; Its Clinical Importance. *Arch. Surg.*, 1940, 41: 1084.

The demonstration of esophageal varices is of clinical importance in the diagnosis of cirrhosis of the liver, of Banti's syndrome, and of primary carcinoma of the liver. It is of great help in the differential diagnosis of hematemesis, ascites, and splenomegaly. The varices produce wormlike, uneven surfaces which bulge into the lumen of the esophagus. These can be demonstrated on a roentgenogram by coating this organ with a thin layer of barium, the ordinary barium-water mixture. They are demonstrated best at the end of deglutition and with the patient in a horizontal position. Esophageal peristalsis and deep respiration will empty the varices.

SAMUEL PERLOW, M.D.

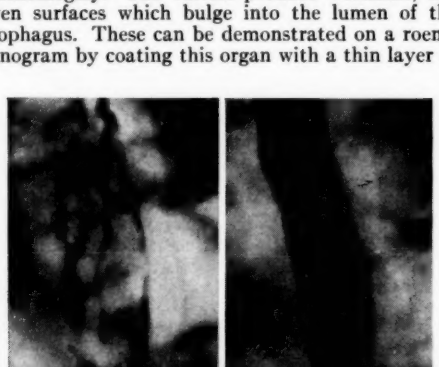

Fig. 1. Changing size of varices during peristalsis in a patient with Banti's syndrome. The two pictures were taken within a few minutes of each other, with identical position of the patient. *A*, extensive varices during the resting phase of the esophagus. *B*, emptying of most varices during the contraction of the esophagus.

Lahey, F. H.: Esophageal Diverticula. *Arch. Surg.*, 1940, 41: 1118.

Historical data show that preternatural pockets in the esophagus were found at autopsy as early as 1764. In 1877 these were classified into traction and pulsion types. In 1922 a new classification was made.

Traction diverticula were first correctly described in 1840. The first surgical treatment was excision, which was done in 1884. In 1909 the two-stage operations were first performed. In 1933 the author modified the two-stage operation.

When the sac was small, the tip of the sac, after dissection, was sutured by the author to the sternohyoid muscle at a level higher than its neck within the wound; when the diverticulum was large the sac was implanted in the wound pointing upward.

Esophageal diverticula divide themselves into two main types: true diverticula represented by the traction type of sac which are made up of all the coats of the esophagus, and false diverticula represented by the pulsion type which are so commonly seen at the pharyngo-esophageal junction and therefore named the "pharyngo-esophageal diverticula." The latter occur at three levels: those at the pharyngo-esophageal junction, represented by the pharyngo-esophageal pulsion diverticula; those in the intrapleural portion of the esophagus, particularly at the level of the main bronchial stem, represented by the traction diverticula; and those just above the diaphragm, the pulsion type.

By far the most common type, and certainly the type most prone to produce troublesome symptoms, is the pharyngo-esophageal diverticulum. This has been well described as corresponding in its origin to an inguinal hernia. It is a true herniation of mucosa and submucosa through the lowest fibers of the inferior constrictor muscle as they run transversely or through the obliquely dividing fibers of the cricopharyngeal muscles on the posterior aspect of the esophagus. This leaves a weak spot on the posterior wall of the esophagus. It consists of a point or dimple on the posterior wall of the pharynx at the cricopharyngeal junction which is unsupported or weakly supported by muscular covering. It is probable that in some persons there is at this point, as in those with true inguinal hernia, a congenital weakness in the muscular covering. Taken together with neuromuscular incoördination, this results in bulging of the mucosa and submucosa at this weak point, just as such bulging occurs through a weak inguinal ring in the early stages of an inguinal hernia. This period is the first stage of the pharyngo-esophageal diverticulum. It is shown in Figure 1a. At this period of development no semblance of a sac is present, only a teatlike projection of mucosa bulges between the oblique fibers of the

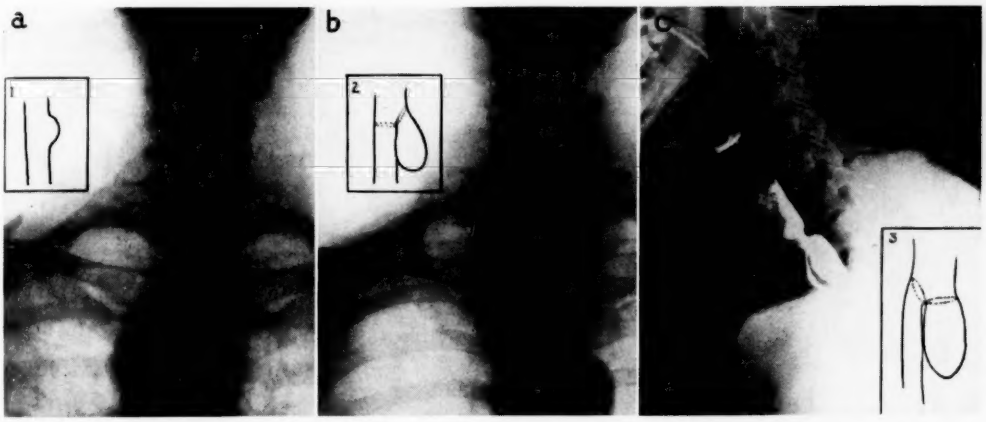

Fig. 1. Roentgenogram *a* demonstrates the smallest type of esophageal diverticulum in its very earliest stage. Note that at this stage the sac has no neck. In insert *1* may be seen diagrammatically the early stage, in which the submucosa bulges through the fibers of the inferior constrictor muscle without as yet having produced a sac possessing a neck. Roentgenogram *b* represents a fully developed esophageal pulsion diverticulum with a definite neck; it is now at an operable stage. Note (insert *2*) the diagrammatic illustration of the relation of the false opening into the diverticulum to the true opening into the esophagus. Note that the opening into the esophagus is in the lateral position at this stage, so that food still passes readily through the transverse opening into the true esophagus without difficulty. Roentgenogram *c* represents the stage of development in the esophageal diverticulum in which because of traction on the sac, the opening into the diverticulum (insert *3*) is transverse and the opening into the esophagus lateral. One can appreciate from this diagram how food passes more readily into the diverticulum sac than into the esophagus and how traction with swallowing on the food-filled sac pulls the lips of the laterally placed opening into the esophagus together, which interferes further with the entrance of food into the true esophagus.

cricopharyngeal muscles and the almost transverse fibers of the inferior constrictor muscle. The earliest symptom associated with esophageal diverticula occurs at this time, solely the feeling of a piece of food stuck in the throat, which causes an annoying cough and an endeavor to get it up. As at this stage, there is no neck to the sac, no operation should be considered. In Figure 1b may be seen the completely formed diverticulum sac with a well developed neck and a dependent sac. This stage represents further advance from the first or teatlike stage and complete herniation of the pharyngo-esophageal mucosa and submucosa between the most inferior fibers of the lowest constrictor muscle and the oblique fibers of the cricopharyngeal muscles. It represents the development of a true hernial sac comparable with the sac of a fully developed oblique inguinal hernia.

In this second stage it is to be noted (Fig. 1b) that while the fully developed sac is still moderately small, the opening into the sac is in the oblique direction on the lateral wall of the esophagus and the opening into the true esophagus is still in the transverse position. In this stage a large portion of the food still passes satisfactorily by the lateral opening of the esophagus into the diverticulum and descends along the longitudinal esophagus into the stomach without obstructive symptoms. The only inconveniences suffered by the patient are those related to the accumulation of food and mucus within the sac. There is regurgitation of food eaten at a previous meal, mixed with mucus. The patient frequently complains that as he swallows food gurgling noises may be heard in the throat.

Stage 3, illustrated in Figure 1c and insert 3, represents the most advanced stage of a pharyngo-esophageal diverticulum. The sac has become large and has descended into the mediastinum. Downward traction on the food-filled sac converts the sac opening (Fig. 1c, roentgenogram and insert) into a transverse one. Downward traction on the sac so angulates the esophagus that the direct course of the descending food is into the diverticulum itself. This tends not only to enlarge the sac but also to force it by the weight of its retained food and by the traction on the food-filled sac with swallowing always in a downward direction into the mediastinum. This likewise angulates the true opening into the esophagus so that it assumes a lateral position. The true opening into the esophagus tends to have its lip so pulled together that, as it is viewed through the esophagus, the opening into the true esophagus is frequently represented only by a longitudinal slit. It is at this stage that obstructive symptoms tend to appear since the first food swallowed fills the sac, and exerts traction on the now laterally placed true opening of the esophagus which tends to close it. Food then finds its way into the true esophagus and stomach with difficulty.

The technique which the author describes is begun by a long longitudinal incision in front of the sterno-

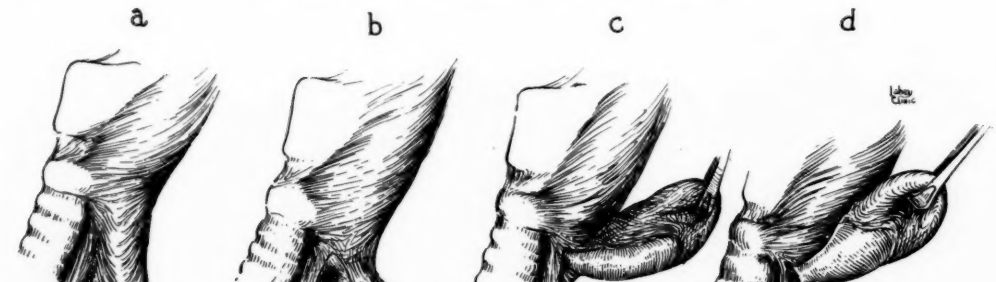

Fig. 2. In illustration *a* may be seen diagrammatically the plan of separating the dependent sac of the diverticulum from the longitudinal esophagus, to which it is adherent and over which run the enveloping fibers of the cricopharyngeal muscles. Note the sac grasped with the Babcock blunt forceps so that traction can be made on it to facilitate the separation. In illustration *b* the anterior fibers enveloping the wall of the sac have been separated, and the posterior fibers are now being cut. Note the appearance of the submucosa as the fibers running over the sac and enveloping it with the longitudinal esophagus are severed. Note particularly (illustration *c*) that the sac has been completely dissected up to its neck and that the sling fibers of the inferior constrictor muscle immediately beneath the neck of the sac have as yet not been severed. It is failure to sever these sling fibers that is so apt to bring about production of a shelf by means of which food is caught and recurrence of the herniation encouraged. In addition to this, failure to cut these sling fibers makes it impossible to mobilize the sac upward so completely that what was an acute angle at the lower aspect of the neck can be adequately converted into an obtuse angle. In illustraton *d* may be seen the completely freed submucosa and the incision of the sling fibers of the inferior constrictor muscle immediately beneath the neck of the sac. This diagrammatic illustration demonstrates the completely mobilized sac with its submucosa and all of the muscle fibers about the neck of the sac freed and cut. It is now ready to be implanted high in the neck.

cleidomastoid muscle. The success of this operation is related to the thoroughness with which the neck of the sac is completely freed of all of its covering muscle fibers. The operative technique of the dissection is shown in Figure 2. This muscle is dissected back until the omohyoid muscle is well demonstrated. The omohyoid muscle is then severed at its upper attachment and at the point where it disappears beneath the sternocleidomastoid muscle. It is amputated at this point. With the omohyoid muscle out of the way the thyroid gland is separated from the internal jugular vein and the common carotid artery, and is pulled toward the middle line. The inferior thyroid artery is cut between forceps and ligated. After this the patient is asked to swallow and the sac of the diverticulum will immediately be seen to ascend and descend. The enveloping fibers of the cricopharyngeal muscles are separated at the lowest angle of the sac and the dome of the sac is grasped with blunt forceps and lifted upward while the neck of the sac is then completely dissected. With the sac hanging entirely by its neck it becomes extremely important to dissect with meticulous care all of the muscle fibers about the neck of the sac and particularly those fibers acting as a sling at the most inferior angle of the neck of the sac, (Fig. 2c).

The sac is then carried upward over the upper pole of the thyroid gland and pinned with two stitches with black silk to the uppermost fibers of the sternohyoid muscle. After this implantation of the sac, the gauze end of a good-sized cigaret drain is inserted into the mediastinum to produce walling-off granulations and is left in place for four or five days. At the end of eight or ten days the second stage of the operation is undertaken. The patient is permitted out of bed and is allowed to swallow food and fluids immediately. Because the tip of the sac is implanted higher than the neck, food at once passes readily by the diverticulum opening into the true esophagus and so on down into the stomach.

At the end of eight or ten days the wound is reopened. The finger is inserted along the sinus of the wound and the edges of the skin are gradually pulled apart. With the wound widely opened, the tip of the sac is located. It is grasped with forceps and it is wiped out of the bed which it has molded for itself in the tissues until it is entirely free. The tip of the sac is then cut off and the two layers making up the

wall of the sac, the mucosa and the submucosa, immediately become plainly evident. The submucosa may then be grasped with forceps and the mucosa can be easily and completely separated from it until it is entirely freed to the neck of the diverticulum. The mucosa is then cut off at the neck of the diverticulum and a small piece of gauze is inserted in the submucosal canal which remains. This drain is then brought out through the wound. Buried stitches are used to approximate the platysma and the subcutaneous fat and the wound is closed with clips. The submucosal canal, which still points upward, collapses after removal of the drain and this prevents postoperative drainage of food through the wound and the establishment of a sinus. The drain within the canal is removed at the end of four or five days, and healing usually occurs without leakage.

Some of the operative complications which can occur are injury to the recurrent laryngeal nerve, and injury to the superior cervical sympathetic ganglion, which will result in drooping of the lids and Horner's syndrome. Another complication can occur when the sac is pulled too far out into the wound and the longitudinal esophagus is displaced and angulated in such a way that food cannot satisfactorily pass down its course. When the diverticula is large, sacs not infrequently become so enormously distended and tense with air that gangrene may result. Should distention of the sac with air occur, a rubber catheter should be inserted into the sac through its tip. If a perforation of the sac or of its neck occurs during a dissection, this should be carefully sutured with silk with inversion of the point of perforation and accurate closure. One of the most distressing complications is a persisting sinus through which food is discharged for several weeks after operation. Such a sinus is in the author's opinion most often the result of incomplete and inadequate dissection of the sac. Another complication is recurrence, which may be the result of incomplete dissection of the sac at the first operation.

Postoperative dilatation is done in the author's clinic by the laryngologists. A Plummer bag is used and wide dilatation is carried out.

Traction diverticula originate from inflammatory processes in adjacent bronchial lymph nodes. These inflammatory processes involve the esophagus, and, as cicatrization occurs, result in traction bands which pull the esophagus out of direction. The symptoms associated with this type of diverticulum are rarely urgent. They consist largely of partial degrees of obstruction or interference with the progress of food and are, as a rule, promptly relieved by dilatation. Because of the fact that most traction diverticula are pulled in either a lateral or upward direction they tend to empty themselves. Operative treatment is not indicated for diverticula of this type.

Pulsion diverticula (supradiaphragmatic) are extremely rare. They have well developed sacs with narrow necks and their lateral walls tend to become adherent to the longitudinal esophagus. The symptoms associated with this type are related to the decomposition of food which remains within such a large sac over a long period and the regurgitation of such food during the night which interferes with sleep.

The author has a method of treatment which has proved satisfactory. With the chest open and the lower lobe of the lung held out of the way, this type of diverticulum can be readily dissected so that it hangs freely by its neck. The dome is then fixed with silk stitches high in the pleural gutter beside the vertebral bodies so that it is implanted upward as a cord parallel to the longitudinal esophagus. The sac can thus be converted into a stringlike structure fixed by stitches of black silk which have not passed through all of the walls of the sac and which are caught to the parietal pleura. Food which passes down the esophagus readily passes by the neck of the sac and can be made to enter the sac only when the patient is placed in the Trendelenburg position.

J. Daniel Willems, M.D.

Neuhof, H., and Rabin, C. B.: Acute Mediastinitis. *Am. J. Roentgenol.*, 1940, 44: 684.

The diagnosis of acute mediastinitis and of mediastinal abscess is based largely on roentgenological examination. The latter is the sole means of accurately localizing such lesions for surgical purposes. Acute mediastinitis will often remain undiagnosed or untreated if roentgenograms are not made, or if its roentgenological features are not understood. Some knowledge of the pathology and the clinical manifestations is necessary for the correct interpretation of films.

Three classifications of acute mediastinitis are made: pathological, etiological, clinical. The pathogenesis is set forth with particular reference to acute infections of the pharynx and injuries to the cervical esophagus. The pathology of mediastinal lymphadenitis, phlegmonous mediastinitis, and mediastinal abscess is described. The special features of mediastinal infection secondary to perforation of the esophagus, and of perforation of mediastinal abscess into the lung are outlined.

The roentgen features of mediastinal lymphadenitis, phlegmonous mediastinitis, and of abscesses in the superior and inferior mediastinum are detailed. Special reference is made to mediastinal abscess derived from esophageal perforation, and to mediastinal abscess which perforates into the lung or the pleura.

A general survey of the clinical manifestations of mediastinal infection is presented; this is based on the cases which were studied, not on the literature. The textbook characteristics of acute mediastinitis were rarely seen. The contrast between large mediastinal abscesses and mild clinical features was emphasized.

The indications for operation and the general principles of operative treatment are discussed.

Paul Merrell, M.D.

MISCELLANEOUS

Tschmarke, G.: A New Method for the Surgical Reduction of the Size of the Chest. Proposal of Operation (Ueber einen neuen Weg zur operativen Brustkorbeinengung. Ein Operationsvorschlag). *Deutsche Ztschr. f. Chir.*, 1940, 253: 472.

The author recalls a statement by Sauerbruch to the effect that one of the main requirements for the further development of the surgical treatment of pulmonary tuberculosis is the obtention of better plombage material. The object of thoracoplasty is the intimate fitting of the form of the thoracic wall to its content, the lungs. From this point of view, there is in the plombage operation a marked malrelation by which the advantages of plombage—the preservation of the thoracic framework and the limitation of the collapse—are actually reduced. This raises the question whether it is not possible to eliminate this malrelation between the form and content in the plombage operation and even to do away with the plombage material altogether.

Perhaps a practical method is offered by reducing the mobilization of the thorax in its expansion, by markedly increasing the mobilization of the thorax in its expansion, or by markedly increasing the mobilization in its intensity: this is possible because the ribs can be made pliable and can be depressed to the desired degree and at the indicated site. The greatest reduction in size can be obtained where the radius of the curvature of the ribs is smallest. The author proposes to cut subperiosteally into segments, from 2 to 3 cm. long, the parts of the ribs that must be mobilized, and to remove sections of bone, 5 mm. wide, in order to prevent blocking of the segments. To avoid oscillation of the mobilized costal parts during breathing and coughing, the author recommends a two-stage intervention in which the ribs with even numbers are cut up in the first sitting and those with odd numbers in the second sitting. In this manner, the stability of the thorax is not endangered and the second stage, which is really the plastic one and follows the first after two or three weeks, is performed during the period of malleable callus formation, and is based on the experience gained from the theory of fractures. This and the strutlike support of the depressed costal parts guarantee the preservation of the depression.

The advantages and disadvantages of the depression plastic are compared with those of the plombage operation. The limitation of the collapse to a minimum with marked protection of the healthy parts of the lung is obtained equally well with both methods. The preservation of the thoracic framework is not completely ensured by either. The severity of the intervention by the former method is greater than that of the latter, but is reduced by the use of two stages and by the absence of pneumolysis. The scar is markedly larger. On the other hand, many disadvantages of the plombage operation are absent: suppuration of the plombage bed, early or late perforation, elimination or displacement of the plombage, and the dangers of pneumolysis. In addition, the limitations of the use of plombage lose much of their significance: danger of perforation when located in the pulmonary border, danger of displacement when the pleuras have not adhered, limitation of the size of the plombage because of the danger of pressure on the heart and the large vessels by the weight of the plombage material. All this shows that the balance is in favor of the depression method.

The mode of action and the possibilities of the procedure are demonstrated by various experiments on models from which plaster casts are taken. Other experiments on models show the extraordinary possibility of reducing the volume of the thorax, for instance, to eliminate residual cavities completely; in this case the anterior lower parts of the lung remain entirely intact, and this is important for the activity of the heart. Up till now, the method has not yet been used in practice, but the author recommends that it be tried. He thinks that difficulties may be offered by the possible persistence of expanded pulmonary tissues and secretory conditions above the depression at the apex, and that there may be obstacles due to intercostal muscle, fascia, adherent pleura and lung, pressure on the heart and vessels, the creation of a new dead space at the apex of the depression, and the technical difficulties of mobilization up to the capitulum.

(Buettner). Richard Kemel, M.D.

Ladd, W. E., and Gross, R. E.: Congenital Diaphragmatic Hernia. *New England J. Med.*, 1940, 223: 917.

The sites where congenital hernia occurs in the diaphragm are in the posterior part of the left and right sides, the foramen of Bochdalek when the defect is due to a persistent pleuroperitoneal canal, the esophageal opening, or the substernal opening commonly referred to as the foramen of Morgagni. Of these hernias, that occurring in a persistent pleuroperitoneal canal is by far the most common. The fact that the hernia through the esophageal hiatus is most common in adult life is due to the high mortality in infancy of patients with a hernia through the pleuroperitoneal canal.

The symptoms of diaphragmatic hernia may be respiratory, circulatory, digestive, or a combination of all three; they depend on the number of abdominal viscera in the thorax and on the size of the hernial ring. In a newborn infant with cyanosis, dyspnea, or vomiting, diaphragmatic hernia is one of the conditions that should be considered.

Physical examination may show unduly rapid respiratory and pulse rates and a heart displaced away from the affected side. Percussion of the chest on the side of the hernia may be dull or tympanitic according to whether there is fluid or air in the misplaced viscera. Auscultation may reveal absent or distant breath sounds and possibly intestinal gurgles that, if present, at once suggest the correct diagnosis. When the major portion of the alimentary

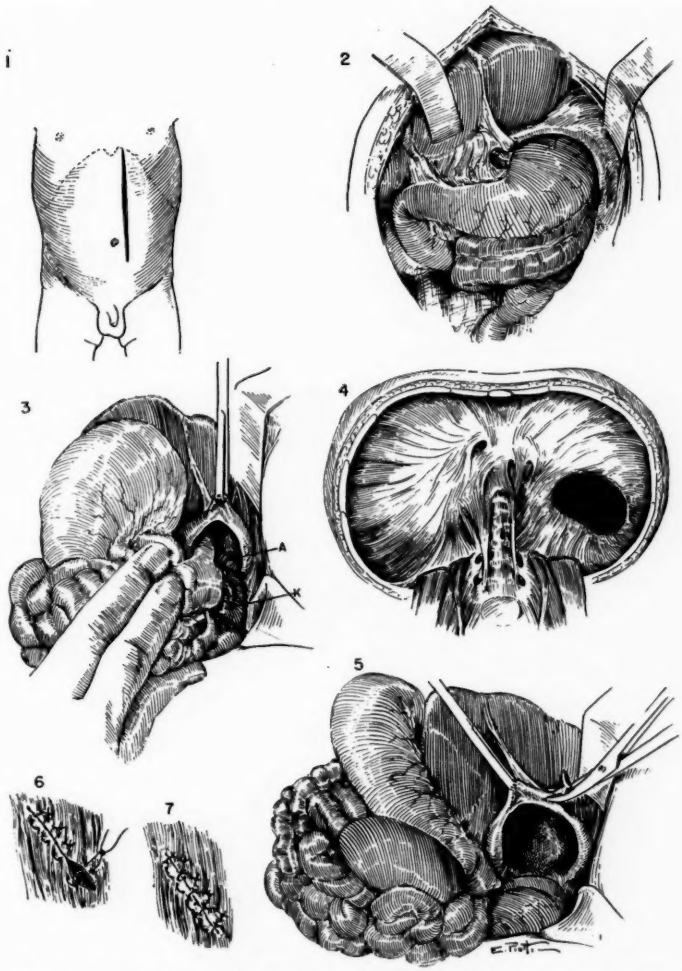

Fig. 1. Steps in the surgical repair of a diaphragmatic hernia on the left side. 1—position of the abdominal incision; 2—view obtained on opening the abdomen (the stomach and colon are seen projecting up through the diaphragmatic defect; all the intestines, except the duodenum, are in the thorax); 3—withdrawal of abdominal viscera from the chest; 4—schematic view of under surface of diaphragm to show position of the opening in the left, posterolateral aspect of the diaphragm; 5—cutting away rim of the hernial ring to make a raw edge; 6—approximation of the diaphragmatic edges with interrupted mattress sutures of silk; 7—reinforcement of peritoneal edges along the suture line with interrupted silk stitches; A—adrenal gland; K—kidney.

tract is in the thorax, tympany is lacking on abdominal percussion, and the abdomen is scaphoid in appearance.

Roentgenological examination should always supplement the history and physical examination. A roentgenogram without the use of contrast media will usually give all the necessary information and is probably safer than giving barium to the baby. If, however, a barium meal is required, only a thin mixture should be used, because there is real danger of causing obstruction or aspiration by giving too thick a mixture to small infants.

The normal findings in the chest are greatly distorted by x-ray examination. The affected side contains viscera that are continuous with those in the abdomen. The mediastinal structures, including the heart, are pushed to the opposite side, and both lungs may be greatly compressed.

The authors believe that there can be no question that surgical therapy is the proper treatment for these patients. There is sufficient evidence, from their experience and in the literature, to confirm the futility of expectant or medical measures.

The policy of waiting until the child gets older and stronger is apparently responsible for the loss of a great many lives that might have been saved by a timely operation. On a theoretical basis, an operation performed in the first forty-eight hours of life is very advantageous. The authors have had an opportunity of doing this in 2 cases. Their experience has shown that infants in the first forty-eight hours of life stand major surgical procedures extremely well—in fact, far better than at the end of a week or ten days. Within the first two days one has the advantage of dealing with the intestine before it has become distended, and thus of being able to replace the intestines in the abdominal cavity, which might otherwise be impossible.

The pre-operative treatment that they believe to be advantageous consists in making sure that the infant is in a proper state of hydration, and that the bowel is deflated as much as possible. The latter can be accomplished by means of enemas, gastric suction, and placing the infant in a tent with a high concentration (from 90 to 95 per cent) of oxygen.

The anesthetic used in the authors' recent cases was cyclopropane. This gives a maximum content of oxygen, slight positive pressure, and good relaxation, all of which are important in these difficult cases. Its one drawback is, of course, its inflammability, but this risk is justified in view of the many advantages that it possesses. Whatever anesthetic is employed, there must always be provision for giving positive pressure if the need should arise.

It is the authors' practice to paralyze the phrenic nerve, through a small supraclavicular incision, on the affected side before attempting repair of the hernia. The purpose of this procedure is to facilitate the closure of the hernial opening and to prevent excessive strain on the suture line during healing of the diaphragmatic wound. Immediately after this, one should proceed with the repair of the hernia.

The operative procedure is illustrated in Figure 1. One of the greatest problems of operating on these patients in early infancy has been that of finding sufficient room in the underdeveloped peritoneal cavity to receive the abdominal viscera. This problem has now been solved by the procedure here reported of closing only the abdominal skin and allowing the abdominal wall to stretch and then suturing the peritoneum and the rectus muscles at a second operation five or six days later. Nine patients have been successfully operated on by the authors.

SAMUEL H. KLEIN, M.D.

Harrington, S. W.: The Diagnosis and Treatment of Various Types of Diaphragmatic Hernia. *Am. J. Surg.*, 1940, 50: 377.

The diagnosis and treatment of diaphragmatic hernia have received more consideration in recent years because the more frequent recognition of this condition has changed its status from that of a rare condition to one that is not infrequently encountered. The diagnosis is of interest to the clinician because it is of first importance, the symptoms are often complex, and the condition frequently must be differentiated from diseases of the upper part of the abdomen and lower part of the thorax. It is of interest to the roentgenologist because the roentgenological recognition of diaphragmatic hernia is often the only means by which a definite diagnosis can be established clinically. The treatment is of primary concern to the surgeon because operative replacement of the herniated viscera and repair of the abnormal opening in the diaphragm are the only measures that promise complete relief of the symptoms to the patient.

From a clinical and surgical standpoint, the history of a preceding injury is helpful in establishing the diagnosis and in determining the type, urgency, and prognosis of the operative treatment. Because of the practical clinical and surgical significance of trauma as a causative factor, the author has suggested that diaphragmatic hernias be classified into two main groups: non-traumatic and traumatic. He has subdivided these two groups according to the various types.

In general, the various types of diaphragmatic hernias can be divided clinically into two main classes, according to the abdominal viscera which are involved. In the first the stomach is the only abdominal viscus incorporated in the hernia and the hernia usually occurs through the esophageal hiatus. In the second, the intestines, with or without the stomach, and other abdominal viscera are included in the hernia. Such a hernia usually is of traumatic origin and is caused by laceration of a normal diaphragm. It also may be of congenital origin and may result from structural deficiency of the diaphragm. Esophageal-hiatus hernia is the most common kind of herniation occurring through the diaphragm that is found among adult persons.

Roentgenography plays an important rôle in the recognition and diagnosis of diaphragmatic hernia. It is also of great value in determining the size and situation of the defect in the diaphragm, considerations which are of aid in deciding upon the method of surgical treatment to be instituted.

Larger types of diaphragmatic hernia, and especially hernias in which a large segment of the stomach or bowel is fixed or incarcerated into the thoracic cavity, are strikingly manifest at roentgenological examination, and often the diagnosis is self-evident. However, frequently, despite pronounced alteration of the thoracic picture, the diagnosis cannot be established without critical study, and small or reducible hernias are likely to escape discovery

unless the examiner is alert for clues that will stimulate thorough search.

Among signs suggestive of hernia that may be elicited during the routine examination of the stomach, displacement of the lower segment of the esophagus is particularly significant and is of common occurrence. In many cases, as the bariumized mixture passes down the gullet, it becomes evident that the lower portion of the esophagus is displaced mesially and that it describes a hook-like curve. In other instances the terminal segment is tortuous but not dilated. In still other cases the segment is angulated. Shortening of the esophagus is noted in the rare instances of congenital shortening. Undue retardation of the barium stream at the hiatus is another potential index of hernia and occurs in many cases.

Scarcely second in importance among signs suggestive of hernia is the observation that the level of the gastric contents is above that of the esophageal aperture.

In 225 cases the patients were treated by radical operation. The herniated abdominal viscera were replaced in the abdomen and the abnormal opening in the diaphragm was repaired. In 133 of these cases the diaphragm was either temporarily or permanently paralyzed preliminary to operative repair of the hernia. In 2 cases it was necessary to perform extrapleural thoracoplasty in addition to the interruption of the phrenic nerve as a preliminary procedure to repair of the hernia. In 223 cases the abdominal approach was employed to repair the hernia; in the remaining 2 cases a combined thoracic and abdominal approach was employed.

In 15 cases it was necessary to perform other operative procedures at the time of repair of the hernia. In 3 cases gastric resection (Polya type) was done, in 1 case for gastric ulcer at the lesser curvature of the stomach and in 2 cases for carcinoma of the pyloric end of the stomach. In 3 cases posterior gastro-enterostomy was performed, in 1 case for high gastric ulcer involving the lower end of the esophagus and in 2 cases for a large duodenal ulcer causing almost complete obstruction of the pyloric end of the stomach. In 5 cases splenectomy was performed. In all of these cases the spleen was firmly adherent to the margins of the opening and to the thoracic side of the diaphragm. Trauma associated with the removal of the spleen from the hernial orifice and the diaphragm necessitated the removal of the spleen in 3 cases, and in 2 cases the spleen was removed because of tuberculosis. In 1 case appendectomy was performed for subacute appendicitis and in 1 case appendicostomy was performed at the time of operation because of obstruction and marked dilatation of the colon.

In 11 cases moderate shortening of the esophagus was associated with the hernia. In 10 of these cases the diaphragm could be sutured entirely above the stomach after the diaphragmatic muscle had been paralyzed by interruption of the phrenic nerve. In 1 case a small portion of the cardia was incorporated in the closure of the hernial orifice.

Twenty-five patients with esophageal-hiatus types of hernia were treated conservatively. In these cases interruption of the left phrenic nerve was done as a palliative or therapeutic measure; in 7 of these cases it was the only procedure contemplated as radical operation was contraindicated, and in the remaining 18 cases the procedure was in the nature of a therapeutic test. It may be necessary to perform radical repair of the hernia in some of these cases at a later date in order to obtain complete relief of symptoms.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Shelley, H. J.: Recurrent Inguinal Hernias; A Study of 282 Hernias and 268 Repairs. *Arch. Surg.*, 1940, 41: 1437.

This study covered 282 recurrent inguinal hernias, of which 268 were repaired. Included were all hernias of this type in patients admitted to the wards of St. Luke's Hospital, New York, from 1926 to 1935, and all repaired between 1916 and 1925 and followed postoperatively for nine months or longer. They comprised 6.4 per cent of all hernias encountered in these two periods and 7.7 per cent of all the inguinal hernias.

Of the 268 hernia repairs, 210 were observed postoperatively for nine months or longer; the average follow-up time was thirty-eight and four-tenths months. Among these were found 39 recurrences, giving an incidence of recurrence of 18.6 per cent. The average postoperative time at which these recurrences were first noted was nineteen and six-tenths months. Only 3 (7.7 per cent) recurrences were indirect, and 36 (92.3 per cent) were direct.

Recurrences followed 14.8 per cent of the repairs of indirect inguinal recurrent hernias done with catgut alone and only 5.9 per cent when a fascial suture was used. However, four times as many wound infections developed after the use of the latter, 17.6 per cent, than when catgut suture material alone was employed, 4.9 per cent. However, none of the infections in either instance was followed by recurrence of the hernia.

In the repairs of direct inguinal recurrences, a second recurrence appeared after the use of catgut alone in 31 per cent; recurrence appeared in only 13.6 per cent when fascial sutures were used. This held true even when the incidence of infected wounds was increased from 2.8 per cent to 6.8 per cent, and 20 per cent of the patients with infected wounds in which fascial sutures were employed had a recurrence later.

Among the group of 128 indirect inguinal recurrent hernias which were repaired, 22 patients did not return for follow-up examination. Eleven were observed postoperatively for less than nine months without a recurrence being discovered. Ninety-five patients were followed for nine months or longer or were found to have a recurrence within less than nine months.

The average length of time over which all followed cases were observed was thirty-two and one-tenth months. The 11 discovered recurrences gave a recurrence rate of 10.5 per cent. The average follow-up period for those followed nine months or more was thirty-six months. Of this group of 95 repairs, recurrences developed in 11, or 11.6 per cent. The average time postoperatively at which the recurrences were first noted was eighteen and one-half months.

Of the 11 recurrences, 90.9 per cent were direct and 9.1 per cent indirect, as compared with the 60 per cent direct and 40 per cent indirect which followed primary repairs of incomplete indirect inguinal hernias.

Of the 154 direct inguinal recurrences studied, 14 were not repaired. Of the 140 patients on whom repairs were performed, 2 died postoperatively, and 15 did not return for follow-up examination. Ten repairs were observed for less than nine months without a recurrence being discovered. A total of 115 repairs were followed postoperatively for nine months or longer or until a recurrence was noted.

The average time covered by the follow-up for the 125 repairs observed postoperatively was thirty-seven and one-half months, and the recurrence rate was 22.4 per cent. For the 115 repairs observed for nine months or longer or until a recurrence was noted, the average follow-up time was forty and four-tenths months, and the recurrence rate was 24.4 per cent. The 28 recurrences were discovered after an average postoperative interval of twenty and six-tenths months.

The proportion of direct and indirect recurrences which followed the repair of direct inguinal recurrences was essentially the same as for the primary repairs; 92.9 per cent direct and 7.1 per cent indirect for the former and 90.9 per cent direct and 9.1 per cent indirect for the latter.

Various significant points regarding the repair of indirect and of direct recurrent inguinal hernias are discussed together, as the recurrences following repairs of these two types of hernias appear as direct or indirect in essentially the same proportions, being predominantly direct in both instances.

Consequently, in the repair of either of these two types of recurrent inguinal hernia, reconstruction of the floor of the inguinal canal is of primary importance. Careful imbrication of the transversalis fascia, with approximation of the inferior edge of the conjoined tendon to the inguinal ligament, appears to be the logical first step in these repairs. This maneuver prevents the insinuation of pieces of properitoneal fat between the later approximated edges of the conjoined tendon and inguinal ligament.

If the groups of followed cases in this study can be considered sufficiently large for the resultant recurrence rates to be accurate, the conclusion must be drawn that these recurrent inguinal hernias should be repaired by the use of a fascial suture. Several authors have in the past few years advocated the substitution of silk suture technique for the use of fascial sutures. To date at St. Luke's Hospital there are no records of sufficiently large groups of repairs with adequately long follow-up periods to enable one to draw any conclusions in this matter. However, until greater numbers of followed cases in the repair of which silk sutures are used exclusively

without selection of cases are available for study, the author is of the opinion that the majority of the recurrent inguinal hernias should be repaired with either the McArthur or the Gallie technique, silk being used throughout for sutures, ligatures, and fixation of the fascial sutures.

Factors influencing the general technique of dissection and repair of these hernias are the same as in the repair of the primary inguinal hernias. Among these are: careful, clean dissection; maintenance of hemostasis and asepsis; care that sutures are not tied too tightly; inclusion of bleeding vessels only, no adjacent tissues are to be included in the ligatures; and reduction of the size of the cord when necessary at its point of exit through the internal ring. SAMUEL H. KLEIN, M.D.

Tuovinen, P. I.: Azotemia and Hypochloremia in Peritonitis (Ueber die Azotaemie und Hypochloraemie bei Peritonitiden). *Acta Soc. med. Fennicae Duodecim*, 1940, Ser. B., 28: Fasc. 3, p. 151.

The author's purpose was to investigate the toxicoses in certain types of peritonitis, especially in dynamic ileus, with the aid of estimations of the sodium chloride and residual nitrogen in the blood. Special attention was paid to the reciprocal relationship between the hypochloremia and the azotemia. The 62 cases examined came from the Surgical Division of the Maria-Krankenhaus at Helsinki. The blood tests were made daily during the critical stage of the disease, as far as possible. The findings are as follows:

In cases of appendicitis peritonitis the toxicosis of peritonitis generally does not appear to be very sensitive to the fluctuation of the sodium chloride in the blood, even in severe cases. The diminution of the salt in the blood is an individual occurrence in a marked degree, and only a continuously low salt content seems to produce a severe disturbance clinically. In case the hypochloremia appears transiently, it occurs during the most critical stage of the disease, the relief of which expresses itself also in a rise of the salt curve nearly to the normal value. On the other hand, however, peritonitis toxicosis is sensitive to azotemia. When the residual nitrogen begins to rise, this should serve as a sign of severe toxicosis. The toxicosis only rarely reveals a correspondence between the rise of the residual nitrogen and a diminution of the sodium-chloride value.

The small group of 4 cases of acute appendicitis without peritonitis showed that the postoperative salt and residual nitrogen contents do not change unless the disease is one which acts injuriously upon the intestinal activity or produces such symptoms as liver or renal functional disturbances, which are associated with a change of these values.

In another group there were 6 cases of peritonitis, 2 of which resulted from a perforated gastric ulcer, and 1 from a perforation of the small intestine. In 2 cases there was a streptococcus peritonitis, originating from an incarcerated femoral hernia, and 1 from postanginose peritonitis which had not been operated upon. In this group of cases of ileus of various etiology no definite regularity in the reciprocal relationship of the blood salt and residual nitrogen was demonstrable. The residual nitrogen frequently appeared to correspond to the fluctuations of the disease, but not as regularly as in the cases of appendicitis peritonitis. A hypochloremia was not observed in these cases.

The material also included a total of 10 cases of postabortal peritonitis and sepsis. These were clinically severe cases, 6 of which ended fatally. The salt content of the blood in the cases with unfavorable course was not as high as in the cured cases and, therefore, it is impossible to speak of an index of the course of the disease. The loss of sodium chloride possibly lost as a result of vomiting or diarrhea does not express itself as a hypochloremia. The residual nitrogen here again was a sensitive index of the course of the disease, and its increase indicated an unfavorable turn. An intestinal paresis was usually associated with the disease, but a mere septic condition in addition to peritoneal irritation would have been able to produce a manifest azotemia.

There were 7 other genital affections in women not immediately due to abortion. The clinical course of these cases was generally favorable. The sodium chloride value in the different cases showed a varying level, but the variations did not correspond with the clinical condition to any noteworthy degree. The residual nitrogen occasionally showed a slight increase in connection with the aggravation of the clinical symptoms.

For purposes of comparison, 8 cases of mechanical ileus were included. In mechanical ileus the sodium chloride content of the blood does not have any important clinical significance. A loss of sodium chloride from vomiting did not reduce the sodium chloride content of the blood. The residual nitrogen did not correspond to the clinical character of the disease or the toxicosis as it did to the character of the inflammatory diseases in the former group. In case the residual nitrogen began to rise, this was a sign of the severe nature of the disease, regardless of whether the preliminary stage of the disease was short or long. However, even in severe cases it happened that the residual nitrogen was only slightly increased.

The last group of cases consisted of 4 malignant tumors and 1 case of peritonitis suspected of being tuberculous. The sodium chloride value of the blood seemed to be labile, but was irregular in regard to the clinical symptoms. The residual nitrogen was frequently increased, but revealed no such close relationship with the clinical symptoms as in peritonitis. In cases in which peritonitis is associated with a malignant tumor the residual nitrogen usually increases markedly.

The determinations of the sodium chloride and of the residual nitrogen contents of the blood are often of value in the follow-up of the ileus toxicosis and in the choice of the treatment. The importance of the azotemia is particularly great, because from

it prognostic conclusions can be drawn relatively early. LOUIS NEUWELT, M.D.

GASTRO-INTESTINAL TRACT

Seifert, E.: Bacterial Development in the Human Stomach and Its Surgical Significance (Die Keimbesiedelung des menschlichen Magens und ihre chirurgische Bedeutung). *Tung-Chi med. Monatsschr.*, 1940, 15: 206.

We have little accurate knowledge regarding either the bacteria or pathogens in the human stomach. In health and in gastric ulcer few are present. There are more in gastritis and in all cases of retention; but especially in cancer, before and after operation, they preponderate in the deeper portions of the gut (Henning). According to the recent literature the decisive factor for bacterial development in the stomach is almost exclusively the degree of hydrochloric-acid production. Hydrochloric-acid deficiency may occur temporarily in excitement or after excessive fatigue. The stomach reflects the life of its bearer more than any other organ (Bayer). These close, multifarious relationships become important in the province of gastric surgery. They illustrate, on the one hand, the strict dependence of the bacterial flora on the acid-producing capacity of the stomach, and, on the other, the significance of bacterial growth in certain questions of management and prognosis in surgical diseases. Thus for the first six hours following perforation of a peptic ulcer into the free abdominal cavity the escaped contents are sterile. For this reason individual surgeons have employed hydrochloric acid not only as a harmless but as a biological antiseptic (Loehr). Also the higher mortality of gastric resection for cancer as compared to that for ulcer may be decreased by gastric lavage with hydrochloric acid for several days preceding operation on the carcinomatous stomach. It has been ascertained that exploratory laparotomy in general entails disturbed wound healing in about 4.5 per cent of cases; when, in addition, an ulcerous stomach is opened this increases to 9 per cent, and in the case of carcinoma of the stomach to 24 per cent, not to mention the mortality.

The author concludes that the fact that the kind and the vigor of the bacterial flora in the stomach stand and fall as the mucosa maintains or lacks its capacity to produce hydrochloric acid is a significant observation. It appears to be imperative that it should be given more consideration than heretofore in the prognosis and management of gastric surgery. (EGGERT). JOHN L. LINDQUIST, M.D.

Benedict, E. B.: Indications for Gastroscopy. *New England J. Med.*, 1940, 223: 925.

Gastroscopy is now a generally accepted method of examining the stomach. It bears much the same relation to gastro-enterology that diagnostic cystoscopy bears to urology.

Gastroscopic examination is easily conducted in the outpatient department with the aid of only one assistant. The technique of local anesthesia is simplified by merely having the patient gargle with a 2 per cent solution of pontocaine. A specially trained head-holder is unnecessary, since the procedure is very satisfactorily carried out with the head resting on small pillows.

The various indications for gastroscopy are discussed and illustrated by 12 case reports. These include gastritis, unexplained gastro-intestinal hemorrhage, so-called "gastric neurosis," peptic ulcer, gastric neoplasm, postoperative examination of the stomach, and foreign body in the stomach.

Chronic gastritis is the most common disease of the stomach; it is difficult to diagnose it clinically, but easy by gastroscopy. Therefore patients with vague gastro-intestinal complaints and negative x-ray findings should have gastroscopic examination. Hemorrhage from gastritis is now a well-recognized clinical entity. Severe bleeding may come from gastritis alone, and may occasionally call for gastric resection. Gastroscopic examination is necessary to establish a positive diagnosis and to follow the course of the disease. The examination should be made within a few days of the bleeding, since otherwise erosions and superficial ulcerations, which may have been the cause of severe hemorrhage, may have healed completely, and the diagnosis will still be in doubt. In some cases of duodenal ulcer with hemorrhage the bleeding may be coming not from the ulcer but from the associated gastritis. The importance of recognizing this is obvious, for if surgery is to be undertaken a knowledge of the degree and extent of the gastritis is essential in order to plan an adequate operation.

A diagnosis of gastric neurosis is not justifiable until gastroscopic examination has ruled out organic disease of the stomach. If chronic gastritis is present it may be the entire cause of the patient's symptoms or at least a major contributing factor. On the other hand, if no lesion is demonstrable either with x-rays or by gastroscopy the patient may rationally be treated for gastric neurosis. Similarly, when gastro-intestinal symptoms persist in the presence of negative or inconclusive x-ray examinations, gastroscopy may establish a positive diagnosis. In fact, no gastro-intestinal study is complete without gastroscopy.

Various problems arise in the diagnosis and treatment of peptic ulcer, some of which may be solved by direct inspection of the gastric mucosa. Gastroscopy may reveal one or more gastric ulcers not previously suspected. Such an observation will naturally modify the treatment. Direct inspection of an ulcer during treatment will be of assistance in evaluating the progress of the healing process. The demonstration of a severe gastritis in association with either a duodenal or a gastric ulcer will sometimes modify the treatment and prognosis. The question of cancer is always of great importance in gastric ulcer. By demonstrating that an ulcer has sharp margins and a clean base the gastroscopist can make a diagnosis of benign ulcer; if the margins are slightly irregular

or the base dirty a diagnosis of cancer must be made. There are, of course, cases in which there will be doubt clinically, roentgenologically, and gastroscopically; such cases must be regarded as cancerous until proved otherwise.

In suspected cancer of the stomach gastroscopy may establish a positive diagnosis. In occasional cases, when other methods of examination have failed, gastroscopy has demonstrated advanced carcinoma. In the differential diagnosis of hypertrophic gastritis, carcinoma, and lymphoma, gastroscopy has been of definite assistance although it has not always given the correct diagnosis.

In cases of postoperative gastritis, jejunal ulcer, or recurrent neoplasm, gastroscopy has given valuable assistance. Postoperative gastritis is a distinct entity, which it is impossible to evaluate or to treat satisfactorily without gastroscopy. Severe cases of this condition with hemorrhage may require further surgery.

In polyposis of the stomach, gastroscopy may differentiate true polyps from enlarged folds or foreign bodies, and in the former will demonstrate the broadness of the base and ulceration of the surface, vital factors in deciding the question as to whether malignant degeneration has occurred.

SAMUEL H. KLEIN, M.D.

Feinberg, B.: Salivation in the Course of Intestinal Occlusion (Die Speichelabsonderung bei Darmverschluss [experimentelle Untersuchung]). *Chirurgija*, 1940, p. 111.

"The loss of 'succus' of the digestive tract with the development of 'succus hunger' and the resulting impoverishment of the body in water and chlorides are the causes of acute death in intestinal occlusion or ileus." In the substantiation of this thesis of Samarin, the author has subjected the function of salivary secretion to a searching investigation. The saliva comprises an essential quantum of the total digestive juices (for 1,500 c.cm. one-fifth of the total amount), but up to the present time it has been almost disregarded by the medical literature. The problem to be investigated is as follows: After the production of ileus does the secretion of saliva remain unchanged as to quantity and quality, or not? Is there an interrelationship between the salivation and the content of succus of the organism which is explained by variations of the salivation, or are other causes at work?

A short description of the investigative technique carried out on 9 dogs is given, the results being illustrated with curves. On each of the first 4 dogs the salivation was first determined in the healthy state; then intestinal occlusion was produced operatively at various levels (duodenum, upper and lower small intestine, colon 50 cm. above the anus) and the salivation was observed until the death of the animal. In the fifth dog the salivation was determined in the fasting animal without the production of ileus. In the sixth to ninth dogs salivation was first determined in the healthy state and then after the production of ileus at the same levels as in the first 4 dogs and the animals received subcutaneous injections of physiological saline solution daily (100 c.cm. per kgm. of body weight).

Qualitatively no changes were determined. With the decrease in the amount of saliva the increase in nitrogen content is produced by a process of condensation, not by an increased content of mucin. Quantitatively there was a decrease of the salivation immediately following the production of ileus, and the higher the level in the digestive tract at which ileus has been produced the more intense and rapid the decrease. The decrease, even to total absence of salivation, continued until death, which in no case resulted from peritonitis. The period of survival of the animal exhibited a close relationship to the functional activity of the salivary glands, as well as to the functional activity of all the glands engaged in the production of digestive juices. The less the amount of secretion, the shorter was the period of survival!

Fasting, as the cause of the decreased salivation, could be excluded with certainty by study of the fifth dog. The cause must be sought in a disturbance of the fluid circulation in the organism—in the loss of water and salts resulting from the loss of digestive juices. The studies in the sixth, seventh, and eighth dogs substantiate this assumption. The administration of physiological saline solution in the higher dosages of 100 c.cm. per kgm. per day was adequate, but the lower dosage of 25 c.cm. per kgm. given in the preliminary studies, was found to be wholly inadequate! It was possible to maintain normal salivation, or at least sufficient salivation until death in the 3 animals with ileus in the region of the duodenum and small intestine—therefore, with ileus in the higher reaches of the intestine—and to lengthen the period of survival of the animal markedly, e.g., the experimental animal with ileus in the duodenum lived for twenty-six days while the corresponding animal of the first series studied which received no physiological saline solution lived only seventy hours. Only in the case of the experimental animal with ileus in the colon was there no effect observed, and indeed an effect was hardly expected, since in these cases which naturally run a protracted course, the digestive juices are still absorbed from the entire upper intestinal tract, and the organisms are not depleted of water and salt to the same degree as is the case in those in which the ileus occurs at higher levels.

In conclusion, the author refers to the indisputable possibility of favorably influencing ileus in the human being by the administration of physiological saline solution, if only sufficient quantities be administered. If in the dog 3 liters were necessary to attain the desired effect, according to the experiments, the usual clinical practice of administering from 600 to 800 c.cm. subcutaneously or 1 liter by Murphy-drip, must be designated as a wholly inadequate procedure.

(SCHOBER). JOHN W. BRENNAN, M.D.

Koeberle, F.: Diffuse Lipoidosis of the Duodenum (Ueber diffuse Lipoidose des Duodenums). *Beitr. z. path. Anat. u. z. allg. Path.*, 1940, 104: 455.

The author presents 5 cases of a change in the duodenum which has not been previously described. This condition appears to be a lipoid deposition causing in the cases under discussion a macroscopic, distinctly visible, yellow coloration. Microscopically the cells in the depth of the mucosa and in the submucosa have a more or less foamy appearance. In polarized light these cells shine brightly, and they are filled with a lipoid-cholesterol mixture. The author traces the origin of these cells in part from the lymph-vessel endothelium and in part from reticular cells and macrophages. He found these changes in 3 per cent of the carefully studied material from 300 cadavers. The changes occurred in cases of gastro-enterostomy, gastric carcinoma, and in cholecystitis.

The author connects the changes with an alteration of the chemical reaction in the duodenal bulb due to anacidity or to the condition following gastro-enterostomy when the gastric secretion does not reach the duodenum. Evidence of the connection lies in the fact that in these cases the changes occurred only in the cephalad portion of the duodenum; nothing is known concerning their pathological significance. (A. Beyer). John L. Lindquist, M.D.

Schuldt, F. C.: Primary Adenocarcinoma of the Appendix and Carcinoid Tumors. *Minnesota Med.*, 1940, 23: 791.

The author reports the case of a man aged sixty-four who gave a history of acute right lower quadrant pain and anorexia of three days' duration. The patient had had an attack of pain in the right lower quadrant of three weeks' duration which had subsided spontaneously a year previously. At operation a ruptured retrocecal appendix containing an adenocarcinoma in its midportion with perforation of the distal portion was found. Apparently the carcinoma had caused obstruction of the lumen which led to the acute process and rupture with peritonitis. The tumor was an adenocarcinoma with gelatinous degeneration. No metastases were noted at operation, but nine months later a hard nodule, similar histologically to the primary tumor, was removed from the scar. Later, ascites, abdominal pain, and steady weight loss indicated probable diffuse abdominal metastases. The malignant nature of the lesion was recognized at the original operation and care was taken to prevent implantation. However, the author believes that in the process of rupture dissemination of the carcinoma cells into the peritoneal cavity occurred.

Carcinoma of the appendix diagnosed pre-operatively has not been reported. The symptoms in this condition as well as in carcinoid of the appendix and mucocele are of a recurrent or chronic type and usually it is futile to attempt to make the diagnosis pre-operatively. The relationship between carcinoid tumors and the argentaffin cells of the Lieberkuehn crypts has been demonstrated by several investigators. The metastatic possibilities of these tumors have been discussed by Hasegawa. Masson has named these tumors "endocrine tumors of the appendix" because of the similarity of the two types of cells which are present to those of the adrenal cortex and medulla.

The incidence of primary malignant tumors of the appendix varies according to published reports. In large clinics about 1 per cent of the carcinomas of the bowel occur in the appendix. Of all primary malignancies of the appendix, 10 per cent are carcinomas and 90 per cent are carcinoids.

John A. Gius, M.D.

Worster-Drought, C., and Shafar, J.: Observations on Megacolon (Hirschsprung's Disease), with Special Reference to an Association with Changes in the Fundus Oculi and Hydrocephalus. *Brit. J. Child. Dis.*, 1940, 37: 153.

This article is worthy of careful consideration, and the disease of more extensive study. The author sets forth in this paper:

1. Examples of an association of megacolon with changes in the fundus oculi.

2. A case of congenital megacolon and congenital hydrocephalus coexisting in the same individual.

3. The definition of Hirschsprung's disease, and various hypotheses regarding the etiology of both megacolon and hydrocephalus.

4. The central control of the functions of the autonomic nervous system.

5. A hypothesis to account for the association of megacolon with hydrocephalus and other disorders of the central nervous system.

Leslie L. McCoy, M.D.

Shedden, W. M.: Cancer of the Rectum and Sigmoid. *New England J. Med.*, 1940, 223: 801.

Most radical resections of the rectum and sigmoid for carcinoma could be avoided if tumors in this region were seen in the stage of precancer, for it is now the opinion of most workers in this field that the adenoma is the precursor of most cancers of the rectum and sigmoid.

The evolution of the precancerous lesion, as accepted by most authorities, begins with a hyperplasia of the mucous membrane, at first invisible; next, one or more adenomas appear. These adenomas manifest themselves as very slight elevations which become deep red as they grow larger. Then there occurs a branching, tree-like process with an ultimate breaking through of the basement membrane.

During this early stage the patient presents no signs or symptoms. For this reason a proctosigmoidoscopic examination should be part of every routine check-up. If adenomas are found they must be destroyed at the earliest possible moment. The only satisfactory method of dealing with an area of hyperplasia or an adenoma in the rectum or sigmoid is by thorough electrodesiccation or cautery

via the proctosigmoidoscope. In order to avoid the risk of perforation of the bowel, it is often safer to divide treatment into several sittings.

It is generally agreed that downward lymphatic spread takes place when the lymphatics of the rectum and sigmoid are blocked from above. Glandular metastasis in cancer of the rectum, however, is not necessarily a late phenomenon. The author cites a case in which a small soft tumor was removed widely by electrodesiccation six years ago. The diagnosis was adenocarcinoma, Grade II. The patient was finally persuaded recently to have a radical resection. The specimen showed no trace of the primary tumor, but two small pararectal nodes contained metastases. It is therefore not safe to depend on the criteria of size, soft consistency, and mobility in estimating the malignancy of a rectal tumor.

Biopsy may not lead to true grading of the tumor. Size is not a reliable criterion of operability; fixation to the prostate is as often due to inflammatory reaction as to carcinoma; and mesenteric-node involvement can practically never be determined before operation. There is little relation between the extent of the growth locally and the presence of liver metastases. Dukes' method of grading cancer of the rectum is a satisfactory supplement to that of Broders.

Failure to recognize symptoms, and economic pressure are causes for the high incidence of advanced cancer of the rectum. Another source of error is the high incidence of double rectal conditions, like hemorrhoids or a fistula occurring concomitantly with cancer. The semiannual examination of any large group of adults, especially in the fifty to seventy-year age groups, would well repay the trouble and organization required by the detection of early rectal cancers as well as their precursors, adenomas and papillomas. In order that more early cancers may be discovered, patients must be examined with the finger, sigmoidoscope, and barium enema before symptoms develop.

The Miles operation is the most popular treatment today. With an operability of 75 per cent in most clinics, and a mortality under 10 per cent, the number of cures is about 50 per cent. Most experienced surgeons agree that the only cases in which the use of radium is justified are those in which a small, early tumor cannot be operated upon because of advanced age or concomitant disease.

HAROLD LAUFMAN, M.D.

Granet, E.: Pruritus Ani; The Etiological Factors and Treatment in 100 Cases. *New England J. Med.*, 1940, 223: 1015.

Pruritus ani is a symptom resulting from numerous causes, some of them obscure. Obvious causes are dermatological entities, that is, mycotic infections, neurodermatitis, lichen planus, psoriasis, oxyuris infestations, and psychoneurosis with anal fixation. Pathological lesions in the lower rectum or anus are responsible wholly or in part for pruritus ani. Among these are redundant prolapsing rectal mucosa, internal hemorrhoids, proctitis, hypertrophied papillæ, cryptitis, fissures, and fistulas. These conditions when found must be eliminated surgically. The concept of pruritus ani as a reflex symptom due to disease in a distant organ is untenable, because it is not supported by satisfactory clinical evidence.

In many cases there appears to be a direct relation between fecal soiling of the perianal skin and the presence of pruritus ani. This is evidenced as a dermatosis induced in the perianal skin by irritant substances in the feces of specifically sensitive (atopic) patients. Evidence favoring this concept exists in studies of the involved skin, which shows changes similar to those found in other types of chemical dermatoses. Positive patch-test reactions to solutions of indole, skatole, and fecal emulsions obtained in some patients with active pruritus ani are further evidence in regard to the cause. It seems likely that constant soiling of the perianal skin with feces is responsible for the recurrences which are so frequent after symptomatic treatment, such as sensory-nerve block by injections of alcohol or anesthetic oils, roentgen-ray therapy, and undercutting operations.

Based on this concept, a routine of management by anal hygiene and medication was instituted in 100 patients with severe pruritus ani. This simple routine of treatment directed toward preventing fecal perianal soiling resulted in subjective and objective improvement ranging from good to excellent in 93 per cent of the 80 patients who followed directions. That fecal soiling is a great factor in the causation of pruritus ani is borne out by the fact that 80 per cent of these patients reported recurrence after an interval of careless anal hygiene or after cessation of treatment. SAMUEL H. KLEIN, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Bisgard, J. D., and Baker, C. P.: Studies Relating to the Pathogenesis of Cholecystitis, Cholelithiasis, and Acute Pancreatitis. *Ann. Surg.*, 1941, 112: 1006.

The importance of infection in the pathogenesis of cholecystitis and cholelithiasis has been overemphasized. Clinical and experimental data establish that an abnormality in the constituency of bile due to stasis, hepatic damage, the presence of pancreatic ferments, or other factors may cause pathological changes in the wall of the gall bladder and, in turn, these changes alter further the chemistry of the contained bile and result in the precipitation and formation of stones.

Pancreatic juice can pass by reflux into the gall bladder, particularly when the pancreatic duct joins the common duct or shares with it a common opening at the ampulla of Vater. This reflux unquestionably takes place in the presence of obstruction and therefore in conjunction with stasis. The authors report 1 case of a patient who died from total loss of

bile and pancreatic secretions through a cholecystocutaneous sinus, and cite 2 cases of acute gangrenous cholecystitis in which there was sterile gall-bladder bile which contained both amylase and trypsin.

Goats were the animals used in these experiments because their gall-bladder bile is similar to that of the human being. They develop cholecystitis and gall stones frequently, and the anatomy of their duct system is well adapted for this study. In goats, the pancreatic duct empties into the common bile duct at a considerable distance proximal to the juncture of the common duct with the duodenum and several millimeters distal to the juncture of the common and cystic ducts. By obstructing the common duct at two levels (above and below the pancreatic duct) an opportunity was afforded for a comparison of the effect upon the gall bladder of stasis alone with that of stasis plus the reflux of pancreatic secretions.

The common duct was obstructed distal to the juncture of the pancreatic duct in 15 animals. The obstruction in 7 was permanent, and in 8 temporary. In the first group all of the animals died; all of the gall bladders contained pancreatic enzymes, blood, and epithelial débris; 3 were sterile; 5 were gangrenous. The pancreas was unaffected in the 2 older animals, and definitely damaged in the 5 infants. In the second group, 3 animals died of acute gangrenous cholecystitis; in 1 of these animals the condition was complicated by acute pancreatitis. Two animals developed a latent stenosis of the distal end of the common duct, and their gall bladders contained both pancreatic enzymes and infection. Five goats developed chronic cholecystitis with infection, and in 3, stones formed. In 3 goats, permanent obstruction with cholecystostomy was done. Although pancreatic enzymes traversed 3 of these gall bladders, in only 1 was there loss of epithelium and necrosis of the wall, and in this animal the drainage sinus closed and the obstruction was no longer decompressed. Pancreatic enzymes thus apparently attack only the gall-bladder wall in the presence of stasis or distention.

The common duct was obstructed proximal to the juncture of the pancreatic duct and distal to the juncture of the cystic duct in 5 goats. One animal had a permanent obstruction, and here stasis plus infection resulted in acute cholecystitis, hepatitis, and multiple liver abscesses, but there was no necrosis of the gall-bladder wall and no pancreatitis. Four goats were subjected to temporary obstruction (stasis of bile without pancreatic reflux). In all but 1, in which partial obstruction persisted, the biliary tract returned to normal and pancreatitis did not occur.

It was concluded that neither stasis nor reflux alone was a pathogenic factor, but that their combination invariably produced acute aseptic cholecystitis with necrosis of the gall-bladder wall; this was induced chemically and was not the result of infection. Superimposed infection was an important factor in the subsequent development of chronic cholecystitis. Stones were precipitated by altered chemistry of the bile and the presence of débris. Biliary stasis alone had no destructive action on the gall-bladder wall, unless infection supervened. Thus, cholecystitis resulted from stasis plus either the reflux of pancreatic secretions or infection, or from a combination of the three factors. The authors believe that these same factors are responsible for chronic cholecystitis in man, after temporary obstruction of the common duct resulting from spasm of the sphincter of Oddi and from reverse peristalsis in the duodenum, in addition to stones or other obstructing factors within the common duct or at the ampulla.

It was assumed that the acute pancreatitis seen in these animals was produced by refluxed bile.

S. Lloyd Teitelman, M.D.

Abell, I., and Abell, I., Jr.: The Question of Drainage Following Cholecystectomy. *Ann. Surg.*, 1941, 112: 1035.

In a study of the need for drainage following cholecystectomy the authors review a series of 500 consecutive cases of cholecystectomy in the absence of surgery upon other portions of the biliary tract or adjacent organs except coincident removal of the appendix.

It has been their practice to employ drainage in every case showing gangrene; marked pericholecystic edema, inflammation, or abscess; demonstrable common duct and pancreatic disease; spillage of bile from the gall bladder or cystic duct; the visible presence of bile in the beds of the gall bladder and cystic duct; abnormal relationships of artery, vein, and ducts which do not permit satisfactory identification and control; and in the instances in which the separation of pericholecystic adhesions has left appreciable denuded surfaces. The drain employed in the presence of these indications is left *in situ* for six or seven days. This period of time is sufficiently long to permit of canalization to insure a route of exit for wound secretions and discharges.

The "ideal cholecystectomy" in which the authors have eliminated drainage is presented by the case in which the common duct is normal in size and gives no evidence of concretions or periductal inflammation; in which the head of the pancreas shows no increase in size or consistency; in which the relations of the cystic duct, of the common duct, and of the cystic artery can be readily defined by dissection with satisfactory identification of each; and in which the gall bladder can be separated from its bed by sharp dissection without exposure of liver tissue. In such instances the cystic duct, with or without the cystic artery, if the relations are suitable, has been doubly ligated with No. 1 chromic catgut ligatures. The connective-tissue bed of the gall bladder is firmly closed by a continuous suture of chromic catgut so that no liver tissue is exposed. At times the stump of the cystic duct was covered with peritoneal flaps, but as a rule this feature was omitted with no difference in the convalescence.

Of the 500 cases reviewed, 109 were drained and 391 were not drained. Acute cholecystitis was present in 74; chronic and subacute cholecystitis in 426. Calculi were present in 408, absent in 92. Of the acute cases, 34 were drained and 40 were not. Of the chronic and subacute cases, 75 were drained and 351 were not. There were 10 deaths in the series, a mortality of 2 per cent, 2 occurring in the 109 cases with drainage and 8 in the 391 cases without drainage. Bronchopneumonia alone accounted for five deaths—2 on the third, 1 on the fourth, 1 on the fifth, and 1 on the twelfth postoperative day. One patient dying on the fifth day presented a marked ileus. Autopsy revealed the peritoneal cavity to be free of pathology. Dehiscence occurred in 2 cases: 1 patient, not drained, exhibiting persistent singultus which began on the third postoperative day, developed wound disruption on the thirteenth day, and died of a terminal bronchopneumonia on the seventeenth day; the other, who was drained, developed a primary bronchopneumonia, suffered a dehiscence on the fifth day, and died on the eighth day. The abdomens of both of these patients were free of evidence of leakage or of peritonitis at the time of resuture.

One patient died of acute hepatic toxemia after removal of a gangrenous gall bladder. One died of mesenteric thrombosis; symptoms appeared on the tenth postoperative day, exploration was made on the eleventh, and death occurred on the twelfth. Since permission for autopsy was refused, the origin of the thrombosis remains conjectural. The tenth fatality occurred on the third postoperative day as a result of myocardial failure and pulmonary edema. It appears that the anomalies of the cystic artery and of the bile ducts do not have the surgical significance which has been accorded them by some observers.

In this series as in the experience of previous years, none of the complications which have been ascribed to closure without drainage has been noted. The arguments which may be offered in favor of the elimination of drains are the avoidance of adhesions which their presence necessarily engenders, and the occasional delay in wound healing induced by infection, with prolongation of convalescence and resultant weakened scars. Collective experience will determine whether or not these advantages outweigh proved dangers. The employment of a careful technique in the performance of operations may avoid some of the conditions for which drainage may be required.

J. A. WOLFER remarked that bile leakage followed drainage of the wound because the drain carried away the plastic exudate necessary to seal the wound in the cystic duct.

C. G. MIXTER remarked that drainage of bile frequently followed back pressure in the common duct. Immediate cholangiography will aid in determining patency of the common duct and show the need of abdominal drainage in certain cases.

MANUEL E. LICHTENSTEIN, M.D.

Elman, R.: The Postcholecystectomy Syndrome. *Surg. Clin. North Am.*, 1940, 20: 1247.

The author states that there is probably no single explanation which applies to all cases in which patients suffer from a recurrence of symptoms after cholecystectomy. He stresses the important teaching that cholecystectomy is not justified just because the patient has abdominal symptoms including dyspepsia and exhibits a pathological cholecystogram.

In a recent series of 100 consecutive cholecystectomies which have been analyzed in their surgical follow-up clinic, 90 patients were completely relieved of their abdominal difficulties following cholecystectomy. Of the remaining 10, 4 had not had severe attacks of pain although they exhibited a pathological gall bladder, and, indeed, the symptomatology had been so multiple and diffuse that failure of cholecystectomy might have been predicted beforehand. The 6 other patients really had severe pain before cholecystectomy, and 4 of them were actually found to be suffering from acute interstitial pancreatitis. This lesion should always be suspected whenever attacks of so-called "biliary colic" are relatively short in duration even though they are accompanied by a slight amount of jaundice. Acute interstitial pancreatitis, unlike true biliary colic due to stones in the common duct, rarely causes pain of more than twelve to twenty-four hours' duration and many of the attacks last merely a few hours. On the other hand, the pain in acute pancreatitis cannot be distinguished from that due to transient obstruction of the cystic duct by stone.

The only certain way of making a differential diagnosis is to observe the patient from the very onset of the attack and obtain a series of blood specimens which are then to be analyzed for their concentration of blood amylase. This test is simple and can be carried out in most clinical laboratories. By this test a definitely high value which falls to normal with the subsidence of the attack will be obtained in patients suffering from acute interstitial pancreatitis. In the author's experience this test has been most helpful, i.e., a high blood amylase value is nearly always diagnostic of an acute lesion in the pancreas, whereas a normal amylase concentration at the height of the attack excludes the pancreas as the cause of the patient's symptoms. The most common error made in the examination of blood for its amylase concentration is a delay in securing the specimen until after the subsidence of the pain. In a very short attack the blood amylase may return to normal within twelve to twenty-four hours; unless the blood is examined within these few hours obviously the opportunity of observing a high figure is lost.

More important than the treatment of the postcholecystectomy syndrome is its prevention. Careful pre-operative study is obviously essential, particularly of the individual attacks of pain. If they are found to be accompanied by a high blood amylase value, a diagnosis of pancreatitis can be made and

the therapy must clearly take the pancreatic lesion into account.

The recurrence of symptoms following cholecystectomy will undoubtedly still plague the patient and surgeon occasionally. This syndrome should, however, become more and more rare with more and more careful study and a wider selection of cases. J. M. MORA, M.D.

Makkas, M.: Functional Insufficiency of the Sphincter of Oddi (Die funktionelle Insuffizienz des Sphincter Oddi). *Chirurg*, 1940, 12: 386.

In those patients in whom the sphincter of Oddi has been rendered insufficient or has been detoured operatively, the duodenal content frequently intrudes into the bile passages, and the same is true when abnormal conditions of communication occur spontaneously between the bile passages and the stomach or intestine. The author has had a case under observation, in which an abnormal communication and destruction of the papilla resulted in an insufficiency of the sphincter, with intrusion of the contrast material into the finest branches of the bile passages, during fluoroscopy of the stomach. The patient had a chronic intermittent arteriomesenterial occlusion at the duodenojejunal flexure. Three months later, although the dilatation of the duodenum was still present, the bile passages were no longer visible. The cause of the abnormality could not be determined at operation.

Six similar cases are abstracted from the literature and 5 more are cited. Likewise, those cases of gas-filling of the bile passages without previous operation or discharge of stone, which may be considered instances of insufficiency of the sphincter, are but rarely reported in the literature. The truly primary insufficiencies of the sphincter of Oddi have never been found except as chance observations in fluoroscopy of the stomach.

The author assumes the cause of sphincter incontinence to be: increase in the intraduodenal pressure, dilatation of the duodenum with distention of the papilla and atony of the sphincter, paresis of the sphincter following cholecystectomy, weakness of the sphincter in cases of duodenal ulcer apparently because of edema of the duodenal wall, and atony of the sphincter in cases of pancreatitis with papillary edema. It is certain that nervous influences of unknown character also play a rôle. Active treatment is not demanded solely because of the ingress of duodenal content into the bile passages.

(STOTZ). JOHN W. BRENNAN, M.D.

Mirizzi, P. L.: Anatomicofunctional Disturbances of the Sphincter of Oddi (Anatomisch-funktionelle Stoerungen des Sphincter Oddi). *Chirurg*, 1940, 12: 378.

The author mentions Rost's experimental demonstration of incontinence in 1917 and of muscular hypertrophy of the sphincter following cholecystectomy; the observations of Del Valle (1925) who showed an actual narrowing of the papilla lumen at reoperation following cholecystectomy; and finally the work of Westphal, Gleichmann, and Mann in 1931, who, experimenting with pharmacodynamic substances and faradic current, were thereby able to differentiate an upper, antral, vagotonic portion and a lower, sympathicotropic portion of the sphincter. The author himself calls attention to the fact that in the same period he has observed these spastic disturbances by means of operative cholangiography.

After a discussion of the nature of inflammation of the sphincter of Oddi, he discusses hypertrophy of the sphincter which, as is well known, develops after cholecystectomy. Hypertrophy, however, is by no means the only cause of the resisting or obstructing papilla. Pronounced hypertrophy of the sphincter occurs with dilatation of the biliary duct corresponding to the hypertrophy of the cardia or sphincter ani with esophageal or rectal enlargement, respectively. There is also a permanent anatomical factor, namely an increase in the contractile substance which usually causes an increased tonus for the most part dependent on spasm. There is then a self-maintaining obstacle at the uppermost end of the sphincter of Oddi, the existence of which can only exceptionally be discovered at autopsy; yet most certainly it is present during life.

The author assumes that dyscinesia as an expression of disturbed function has its basis in partial contractions initiated through the sympathicotropic portion of the sphincter, which are also responsible for the reflux of bile into the duct of Wirsung. This can be well demonstrated by operative cholangiography. If the width, form, and course of the hepatocholedochus permit, one can also visualize by operative cholangiography the nature of the inflammation which is causing stenosis of the sphincter of Oddi.

Especially significant is the question as to whether or not a subsiding or stationary condition is present because the following rule for management may be laid down: a persistent inflammation of the sphincter of Oddi makes a drainage operation absolutely necessary. Roentgen films of operative cholangiography which accompany the original article permit recognition of the various conditions.

(STOTZ). JOHN L. LINDQUIST, M.D.

MISCELLANEOUS

Rippy, E. L.: Perforating Gunshot Wounds of the Abdomen. *J. Am. M. Ass.*, 1940, 115: 1760.

Rippy presents a study of 292 cases of gunshot wounds of the abdomen. Of the 24 patients in whom exploration was not done, 23 (95.8 per cent) died. However, among 268 cases in which exploration was done there were 166 deaths, a mortality of 61.9 per cent. This report considers only those cases in which there were visceral perforations.

It has been repeatedly said that the smaller the caliber of the rifle or pistol the lower the mortality, and this is confirmed in Rippy's study.

The age incidence showed that the greatest number of cases occurred between the ages of twenty-one

and thirty. The mortality increased steadily with the decades of life. The mortality in the colored race was 62.3 per cent as contrasted with 68.8 per cent in the white race, and the mortality in the female was 61.2 per cent as against 65.4 per cent in the male.

Rippy believes that x-ray examination should be discouraged as a routine procedure because of the imposed pre-operative delay and the added moving and handling of patients. The earlier the operation, the greater was the chance of recovery.

As shown by others, this study reveals that the amount of hemorrhage is the greatest single factor in the determination of the mortality. Transfusions were given from one to ten times in 99 of the patients. Results showed that in those who received blood the mortality was 8 per cent lower than in those who did not.

The second most important factor in the death rate is the organ, or organs, perforated. The mortality increases when more than one organ is perforated, as the number of holes and the degree of destruction of the organs increase, and as the site of perforation descends in the intestinal tract.

From the standpoint of surgery, simple closure is recommended for perforation. Resection is associated with a high mortality. Ether was the anesthetic of choice because it gave the required relaxation and was not associated with very much shock. The mortality decreased as the length of time required for the operation increased. This was due in part to the fact that the hasty operator is more likely to overlook perforations.

The vast majority of deaths occurred within twenty-four hours. Rippy arbitrarily classed the deaths which occurred within twenty-four hours as being caused by shock and hemorrhage (59.8 per cent), and those which occurred after twenty-four hours as being due to peritonitis or some cause other than shock.

In an effort to lower the mortality figure, the promptness of preparation for operation, choice of anesthetic, operative technique, length of the procedure, and pre-operative and postoperative management are all considered as important factors that are under the surgeon's control.

EARL GARSIDE, M.D.

GYNECOLOGY

UTERUS

Kidd, L. S.: A Consideration of Some Problems Associated with Carcinoma of the Cervix. *Australian & New Zealand J. Surg.*, 1940, 10: 123.

In this report the author gives consideration to several selected aspects of the position of surgery in the treatment of carcinoma of the cervix. The Commonwealth Department of Health in Australia issues an annual review of results obtained by various methods. The only conclusion from this review was that the highest percentage of cures was produced by the combination of surgery and radium. Radium alone, however, was the method selected for the treatment of the greatest number of patients. A comparison of the results is dependent upon the interpretation of the intrapelvic and vaginal conditions by the clinician at the first examination. On this interpretation depends the classification with the associated percentage of success or failure.

Of operable cases in which enlarged glands are present in the broad ligaments, 57 per cent are not malignant. Because of complicating sepsis, they may be firm, fibrotic, and surrounded by a suggestive hardness, which is difficult to differentiate from malignant invasion by palpation. Calcified and tuberculous glands may appear in this vicinity.

In 10 per cent of cases of carcinoma of the cervix there is an associated endometriosis of the lymph glands; the glands are of stony hardness and densely adherent to the surrounding structures, but they react in a pleasing way to radiation.

Only when the combined method of surgery and radium is employed is it possible to evaluate these factors, the exploration revealing the exact state of affairs in the pelvis. The statistics of this technique, besides being the best, are the only reliable ones because they are based on a correct interpretation after direct inspection.

When radiotherapy is used alone, an opinion should not be recorded until a retrospective interpretation has been made after the infected malignant ulceration on the portio vaginalis has healed. The success of radium treatment depends upon a lethal dose of x-rays penetrating the whole field of invasion, as evenly as possible, from the cervix to the extreme edge of the lymphatic spread.

After the use of radium in the cervix, it is the practice of the author to open the abdomen eight weeks later. In suitable cases, a panhysterectomy is performed. The broad ligaments are split open and the peritoneum is lifted off the iliac vessels. The glands which are not firmly fixed are removed, but the lymphatic bed is disturbed as little as possible. The field is now ready for the implantation of radon. The author describes this procedure in detail.

He notes that no results will be satisfactory until it is universally recognized that the earliest phases of this disease give no warning symptoms and only trivial signs. The disease must be diagnosed by careful inspection, early biopsy, and iodine testing, when it is either in the almost stationary, precancerous stage, or when it presents the small localized malignant plaque described by Schiller.

HERBERT F. THURSTON, M.D.

Rauramo, M., and Turpeinen, E.: The Finer Cell Structure in Carcinoma of the Uterine Body (Ueber die feineren Zellstrukturen bei Carcinoma Corporis Uteri). *Acta Soc. med. Fennicae Duodecim*, 1940, Ser. B, 29: Fasc. 2, p. 164.

The authors have studied the cell structure in 17 cases of carcinoma of the uterine body, paying special attention to the microcentrum, the silver impregnated parts, and the chondrosomes, and using the old classification of adenomatous and solid carcinomas. They state that their observations do not justify their treating their results as those of different groups, and therefore they present them simply under the term of carcinoma of the uterine body.

The form and size of the tumor cells showed great variations. Compared to the cells of the normal, single-layer, glandular epithelium, those of the multiple-layer epithelium and of the epithelial islands were generally smaller and their form was not cylindrical, but cubical or quite irregular. On the other hand, most of the nuclei were of the same size or larger than those of normal epithelium and their form was round or oval in the few anaplastic cells found, but assumed practically any aspect (round, elongated, curved, partly constricted, angular) in medullary carcinoma. The microcentrum was regularly observed in preparations stained with Heidenhain's iron hematoxylin, even when the nucleus was already badly altered. It was usually found at the apical pole of the cell and was surrounded by a clear round halo; when it was near the nucleus, the surrounding cellular plasma did not show the halo, but was often darker than in the remaining parts of the cell. The microcentrum contained mostly two centrioles, which touched one another with their base and formed a diplosome. The centrodesmus could not be demonstrated with the staining method used. In the anaplastic epithelial cells, there were always microcentrums with more than two centrioles, which seemed to occur in pairs and were grouped without arrangement in a number of cases. A microcentrum with more than two centrioles did not show a halo. The centrioles were usually of the same size and form.

Silver impregnated parts were relatively scarce and, although some impregnated particles were found in practically every preparation, a Golgi network was observed in only one-half of the cases. The coils were sharply delimited; they were small groups of threads, stained black with plicated bor-

ders; often they appeared not to lie in the same plane as the nuclei, but they were usually close to them; two coils could be found in some cells and one was then on the side of the basal membrane; in general, they lay toward the lumen. Silver-stained chondrosome particles and rods were present in all preparations, generally at the borders of the cells and in the vicinity of the lumen.

The chondrosomes were best stained by Altmann-Kull's method, but the staining could not be too prolonged. Their form varied greatly, but they appeared mostly as punctiform granules and thread-like structures. In some cells, they showed as fine, serpentine threads directed longitudinally: their length was from one-third to one-fourth that of the cell and they lay close to the nucleus or in the border portions of the plasma without any special arrangement. The number of threads varied and at times they filled the entire cell. Some chondrosomes presented relatively large granules and short rods and the granules were often grouped around the nucleus. The chondrosomes were scarcest in the anaplastic tumor cells and often consisted of very small dots: in some of these cells there were also very fine threads. RICHARD KEMEL, M.D.

Turunen, A.: Investigations on the Histological Structure and the Cell Structure of the Secondary Ovarian Carcinomas; Some Clinical Observations (Untersuchungen ueber den histologischen Bau und die Zellstrukturen der sekundaeren Ovarialkarzinome nebst einigen Beobachtungen ueber deren Klinik). *Acta Soc. med. Fennicae Duodecim*, 1940, Ser. B, 28: Fasc. 3, p. 99.

Secondary carcinoma of the ovary is no histologically uniform type of tumor. It should be considered as a combination tumor, formed in one part from the metastatic carcinomatous epithelium and, in the other, from the tumor stroma produced by the proliferation of the ovarian stroma. In the superficial parts of the tumor one often sees normal ovarian tissue with follicles and corpora lutea. The peculiar histological structure of this tumor depends mostly upon the independent proliferative property of its stroma tissue and also upon the intracellular and intercellular collection of mucoid substance of epithelial origin in this tissue.

The epithelial cells of the tumors are in general similar to the epithelial cells of the primary carcinoma in that the more anaplastic the epithelium of the primary tumor, the further removed is also the epithelium of the ovarian metastasis from the cylindrical epithelium. Nevertheless, in certain cases, in which very little adenomatous structure could be found, the ovarian metastasis was almost generally adenomatous.

In the ovarian metastases the anaplastic epithelial cells were poorer in cytoplasm, and in them there were more abundant regressive changes, especially vacuolization and mucoid metamorphosis, than in the cells of the primary carcinoma. There were no giant cells in the metastatic tumors, although they were found to some extent in the primary tumors. The less anaplastic cells, still showing the cylindrical form of the adenomatous secondary carcinoma, were mostly of the same type as the cells of the primary carcinoma.

Signet-ring cells could not be found in the primary tumors studied by the author, but they appeared in more than half of the metastatic ovarian tumors; the largest number were found in the most anaplastic tumors and the smallest number in the adenocarcinomatous tumors. The successive development of the signet-ring cells from the small epithelial cells poor in cytoplasm could be followed, so that the epithelial origin of these cells is certain. In these one could always obtain a positive reaction with mucicarmine and determine how their content emptied itself into the intercellular tissue. In the mucoid unchanged portion there was a granulation, and with certain tinctorial methods a distinctly reticular structure could be demonstrated. The spherical formations in the nodal points of the reticulum did not appear with the chondrosome staining, but the reticulum appeared partially with the employment of silver impregnation methods.

The collagenic connective tissue of the metastatic ovarian tumors in the more anaplastic tumors in the region of the epithelial islands is a dense and, in the intermediate areas, a slightly reticular felting. In the adenomatous tumors the tubular glands were usually lined with a membrana propria. Except in 1 case, the stroma tissue in them was generally more compact than in the previous cases. In the former there is also found between the connective-tissue fibrils, abundant intercellular substance reacting positively to mucoid reagents, in the latter it is more sparse. Elastic fibers are few; they are preferentially in the capsule.

The stroma tissue of the tumor often proliferates markedly at the edges of the smaller epithelial islands, and one can then observe in these islands an epithelial cell degeneration and disappearance of the cells. As a result of the latter, tissue which suggests a reticular fatty tissue extracted with fat-dissolving substances occasionally appears in large areas. In places the stroma proliferation forms fairly complete epithelial-free tumor areas of the type of a loose fibroma. The mesenchymal cells in general show the type of the resting fibroblasts, and more rarely are found in the stimulative state. The sarcoma cells do not contain any stroma, nor do the mesenchymal cells show any mucoid changes.

The abundant mucoid substance in the tumor is of epithelial origin and in places controls the histological picture completely. According to the author's opinion, the rapid growth of these tumors in most cases depends largely upon the accumulation of mucoid substance in the tumor and, therefore, not upon the fact that the ovary presents especially favorable conditions of growth to the cancer cells. The mucoid substance also fills the deeper or superficial cystic cavities produced by the necrosis in the tumor.

Exudate cells are found in the metastatic ovarian tumors much less often than in the primary tumors. The former reveal chiefly mast cells and lymphocytes. In the primary tumors abundant plasma cells as well as neutrophile granulocytes also appear. Undoubtedly the greater frequency of the inflammatory cells in the primary tumors depends upon a bacterial infection, which is not present in the metastatic tumors.

The finer structures were almost the same in the metastatic and the primary tumors. The microcentrum of the epithelial cells was almost regularly formed by two centrioles, only rarely by three. In the cells which retained their cylindrical form, it was situated at an oblique angle with the longitudinal axis of the cell. In the signet-ring cells it was located in the end of the cells opposite to the nuclei or in the lateral parts of the cells, far removed from the nuclei.

The chondrosomes were spherical, sometimes rod shaped, and their localization corresponded with the plasma network. The surroundings of the nucleus and of the microcentrum were free from chondrosomes, as were also the ends of the cylindrical cells turned toward the glandular tube. The chondrosomes of the primary tumors were of the same type as those of the ovarian metastases.

The internal reticular apparatus appears in its most developed form in the cylindrical epithelial cells of the adenomatous tubes and lies in the end of the tubes directed toward the glandular lumen, very near to the nucleus. The more primitive the glandular tubes the more irregular appeared the apparatus in relationship to the glandular lumen; and the more anaplastic the cells were, the more independent was the apparatus in regard to its form. The apparatus of the primary tumors was of the same type as that of the secondary tumors.

In the material studied, 6 patients were operated upon "radically," both the primary carcinoma and the secondary ovarian carcinomas being removed. Of these, 1 patient is still free from a recurrence after two years of observation and 1 lived for two years and nine months after the operation and died from metastasis in the shoulder. Only in 1 case was a local recurrence found in the pelvis. Most of the patients died from the primary tumor or its local recurrence. It is possible, therefore, to achieve a permanent cure in the cases in which the primary tumor is removed radically and the ovarian metastases are extirpated in time. The iliac and paraaortic glands were found normal in almost all of the cases. LOUIS NEUWELT, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Emge, L. A.: Functional and Growth Characteristics of Struma Ovarii. *Am. J. Obst. & Gynec.*, 1940, 40: 738.

From 5 to 6 per cent of ovarian strumas produce thyrotoxicosis. Morphological changes do not necessarily parallel the degree of toxicosis.

The majority of ovarian strumas store very little iodine. The degree of iodine storage does not parallel morphological changes.

The fact that some ovarian strumas can produce malignant metastases makes it imperative that careful study of the abdominal cavity be done at the time of operation and that bone surveys be made at least once a year thereafter. It is possible at times to remove part of the metastases safely, particularly when the condition gives rise to thyrotoxic disturbances, or when bone implantation has occurred. From 5 to 6 per cent of these tumors produce metastases, and half of the latter kill by malignant invasion. EDWARD L. CORNELL, M.D.

Treite, P.: Concerning 2 Cases of Theca-Cell Tumors as the Cause of Postclimacteric Bleeding (Ueber zwei Faelle von Thecazelltumoren als Ursache postklimakterischer Blutungen). *Zentralbl. f. Gynaek.*, 1940, p. 877.

Endometrial hyperplasia is a frequent finding in the climacteric, although in the postclimacteric period the endometrium is generally atrophic. The cause of the hyperplasia is a pathological increase of the follicular hormone. In the postclimacteric individual an ovarian tumor should be suspected as the source of the increased hormone production.

Granulosa-cell tumors and theca-cell tumors belong to the group of ovarian tumors which produce follicular hormone. The theca-cell tumor is less frequently observed than the granulosa-cell tumor, only 33 cases having been cited in the literature. The author reports 2 new cases observed by him in 2 patients, both sixty-four years old. Both patients were admitted to the clinic because of bleeding. At operation, in each case, only a small, yellow tumor, the size of a hazel-nut, was found in an ovary. Histologically these tumors showed the structure of a theca-cell tumor. The uterine mucosa, as always in these cases, was frankly hyperplastic. In 1 case the proliferation of the mucosa was so intense that it had formed so-called "proliferation cysts," and the possibility of malignant degeneration had to be considered. In such cases, it is recommended that the uterus together with its adnexa be removed, even if the gynecological findings are negative.
(MAUER). RONALD R. GREENE, M.D.

Martzloff, K. H.: Primary Cancer of the Fallopian Tube. *Am. J. Obst. & Gynec.*, 1940, 40: 804.

A case is reported of primary carcinoma of the fallopian tube which was tentatively diagnosed before operation. The patient is alive and well four years after operation. Since preparation of this paper the patient has developed a cervical lymphadenopathy on the left side. Tissue removed for biopsy revealed an obvious metastatic carcinoma. The symptoms and signs of this comparatively rare disease, as one obtains them from the literature, are so protean, and in general so similar to other types of adnexal disease that there is little logical basis for suspecting its existence.

A tentative diagnosis of primary carcinoma of the fallopian tube, however, can logically be considered in that limited group of patients who present the syndrome of hydrops tubæ profluens with a serosanguineous vaginal discharge but no causative vaginal or uterine pathology. Hysterosalpingography should have a definite place in the establishment of a provisional clinical diagnosis, especially if palpable pelvic abnormality is not demonstrable. The high degree of malignancy of this disease, as generally stated in the literature, is in some instances probably more apparent than real when one considers, as in the case herein reported, the long duration of the disease before operation. The use of high voltage roentgen-ray therapy is recommended by numerous authors. However, there is at the present time no suitable information available that indicates its value in the treatment of the disease.

In the discussion RUBIN stated that 1 case of primary carcinoma of the fallopian tube and 4 secondary cases were encountered in 410 cases of carcinoma of the female genital tract. The case is reported in detail. EDWARD L. CORNELL, M.D.

EXTERNAL GENITALIA

Taussig, F. J.: Cancer of the Vulva. *Am. J. Obst. & Gynec.*, 1940, 40: 764.

Early recognition and prompt adequate treatment are extremely rare in cancer of the vulva. In spite of this the disease, because of its relatively slow growth, offers a reasonably good prognosis. Prevention of carcinoma of the vulva by early excision of the leucoplakic vulva should materially lower the incidence of the disease. Roentgenological treatment of the disease gives disappointing results, and is usually attended by painful burns. The complete modified Basset operation gives splendid results in patients with operable lesions (Clinical Groups 1 to 3) who are under sixty-five years of age. In older patients only those in better than average physical condition with relatively early lesions should be subjected to this procedure. Approximately two-thirds of the cases of cancer of the vulva are still operable at the first examination. In those in whom a Basset operation is done we can expect a five-year survival in about 3 of 5 (58.5 per cent), even though 2 of 5 (41 per cent) already show evidence of lymph-gland metastasis. EDWARD L. CORNELL, M.D.

Cosbie, W. G.: Carcinoma of the Vulva. *Canadian M. Ass. J.*, 1940, 43: 439.

The author reports his findings in a study of 59 patients who have been treated for carcinoma of the vulva in the Toronto General Hospital and the Ontario Institute of Radiotherapy, Toronto, since 1929. Fifty-six had squamous-cell carcinoma, 2 had melanotic carcinoma, and 1 had carcinoma of Bartholin's gland. Carcinoma of the vulva is a disease of later life; the oldest patient was seventy-nine, and the youngest forty-one, the average age being sixty-two years.

Pruritus vulvæ was the most common symptom. Other complaints included pain in the vulva, lump in the vulva, ulceration of the vulva, tenderness at the time of urination, bleeding, and discharge.

The most frequent location was in the greater labium where the growth started as a surface plaque or nodule, later underwent superficial ulceration, and gradually invaded and became fixed to underlying structures. The lesser labium was the next most frequent site and the majority of the tumors which involved the clitoris originated where the labia formed the prepuce. Involvement of the vestibule seemed to result from spread of the tumor. The more extensive cancers showed a destruction of tissue and were accompanied by excavating ulcerations. The inguinal lymph nodes were frequently enlarged. However, in one-third of the patients in whom such nodes were palpable, it was proved microscopically that this was due to infection, and not to cancer.

Twenty-one patients had leucoplakia vulvæ. All of this group suffered from pruritus or vulval pain.

The diagnosis of carcinoma of the vulva is not difficult. However, only 25 patients presented themselves within one year after the onset of symptoms. It appears that elderly women are prone to delay seeking advice through fear, modesty, or ignorance. Twenty-seven patients had had symptoms for more than two years, and 8 others had known of painless nodules in the vulva for from two to ten years.

The cases of melanotic carcinoma and Bartholin-gland cancer are reported in detail. One of the patients with melanotic cancer died within a year, and the other one succumbed after seven months. The patient with cancer of the Bartholin gland died six years after operation.

This study emphasizes the insidiousness of carcinoma of the vulva. Local recurrences may appear years after irradiation treatment. Gland involvement has been observed as late as ten years after an operation which consisted of vulvectomy and incomplete gland excision.

Radical vulvectomy is the treatment of choice for cancer of the vulva although the age and physical state of the patient may influence the decision regarding appropriate management for individual cases. The radical operation is not attended by the degree of shock which might be expected. "After removal of the vulva a bilateral gland excision is performed. A semilunar incision is made from the anterior superior iliac spine to the pubic spine and is carried down to the superficial fascia. The gland-bearing fatty tissue of Scarpa's triangle is removed *en bloc*. The long saphenous vein is ligated and cut at the apex of the triangle and the whole mass of tissue is reflected to clear the fascia lata and clearly expose the fossa ovalis. The saphenous vein is ligated and cut where it enters the femoral vein, and the femoral canal is cleared of all fatty tissue, thus removing the highest lymph node of the chain—the gland of Cloquet."

These 59 cases were divided according to the type of treatment received—(1) irradiation, (2) surgery,

(3) irradiation followed by surgery, and (4) surgery followed by irradiation. Nineteen patients have been subjected to radical operation; 68 per cent of them are living. Neglect of symptoms results in an unnecessarily high percentage of advanced cases. Radical vulvectomy offers a hopeful prognosis, but simple vulvectomy and indifferent gland excision are not recommended if one expects to cure many cancers of the vulva. Radiotherapy is of value in the treatment of elderly patients.

GEORGE H. GARDNER, M.D.

MISCELLANEOUS

Stallworthy, J.: An Investigation into the Result of Operation in Genital Prolapse. *J. Obst. & Gynaec. Brit. Emp.*, 1940, 47: 391.

The aim in the treatment of prolapse is to leave the vagina as normal as possible in length, diameter, and mobility. Only when this aim is achieved can the operation be considered perfectly successful.

The records of 488 operations for prolapse performed by 8 gynecological surgeons at the Chelsea Hospital for Women were studied. The technique of the operation varied with the individual surgeon. The longest interval between the times of operation and examination was ten years and the shortest was two years. Two hundred and sixty-eight patients on whom 285 operations had been performed were interviewed and examined. The author includes in this series of genital prolapse, cases of "vaginal wall prolapse," as well as cases of true procidentia. On 177 occasions, constituting 63 per cent of the series, a combined anterior and posterior wall repair was performed. A posterior wall repair alone was required on 78 occasions as compared with the 21 on which an anterior wall repair was necessary.

Prolapse recurred in 13 per cent, one-fifth of these cases occurring after parturition. There was no recurrence in 58 per cent of the patients who became pregnant after operation and who were delivered vaginally. Sixteen failures were due to the development of a cystocele, urethrocele, or both combined. Ten failures were due to the development of a rectocele. The shortest time in which symptoms recurred was immediately after the patient left the hospital and the longest was eight years after operation.

Dyspareunia was complained of after operation by 25 per cent of all the patients, and was permanent in 10 per cent. In 12 patients a definite mechanical cause was found as follows: stenosed introitus, 5; generalized vaginal stenosis, 1; tender stricture in the vagina, 2; tender perineal scar, 1; retroverted tender uterus, 2; and senile vaginitis, 1. In the remaining 16 patients the cause of the dyspareunia was probably functional. The necessity for warning patients of a possible initial difficulty in intercourse after a vaginal plastic operation is emphasized.

Stress incontinence was the most common complication, and occurred 43 times, or in 16 per cent of the series. In 23, the incontinence was troublesome only at intervals. The occurrence or persistence of stress incontinence after a prolapse operation is due to faulty technique in not extending the anterior colporrhaphy sufficiently far down the vaginal wall to permit adequate support to the urethra itself.

A recurrent sensation of "something dropping" was complained of by 16 patients. No signs of prolapse were found in 4. In 9 cases, symptoms were due to weakness in a vaginal wall reported to be normal at the primary operation, which consisted of the repair of one vaginal wall only. In 6 cases a second operation was necessary to repair the subsequent prolapse of the opposite wall. In 5 cases this was the anterior wall and in 1, the posterior. These results indicate the importance of making certain that there is no weakness of the opposite wall before a single colporrhaphy is performed. There is a risk in approximately 6 per cent of trouble occurring later because of prolapse of the remaining wall.

During the years from which this series was collected 1,310 consecutive repair operations were performed with 11 deaths, a mortality of 0.8 per cent. The most common cause of death was myocardial failure (4 cases). Three of the deaths were due to infection. The importance of making a careful examination of the cardiovascular system in every patient before finally advising surgical treatment for prolapse is evident. DANIEL G. MORTON, M.D.

Effkemann, G., and Werle, E.: The Importance of Histamine Metabolism in the Pregnant and Non-Pregnant Female Organism (Die Bedeutung des Histaminstoffwechsels im weiblichen schwangeren und nichtschwangeren Organismus). *Arch. f. Gynaek.*, 1940, 170: 173.

The facts which appear to make the histamine metabolism of functional importance for the female genital organs during or in the absence of pregnancy are surveyed. The present investigations record a high histamine content of the normal non-pregnant uterus of human beings and animals. The blood of pregnant women was found to possess a disproportionately high capacity to split up histamine, which is based upon the presence of histaminase in the blood. This increased capacity of histamine detoxication in the blood is specific in pregnancy. The histamine content of maternal blood is at the lowest level of the norm during pregnancy. In the uterus muscle itself histaminase was not found or if it was it was only of low activity. In the fetal blood circulation the placenta showed a strong histaminase activity. Its histamine content was particularly low. Histaminase in the blood of the newborn was not increased, but the fetal metabolism caused histamine to be liberated in larger amounts and it appeared in higher quantity in the blood of the newborn. Only after ejection of the placenta did the histaminase spread rapidly into the surrounding placental blood. The importance of the increased histamine metabolism lies, first of all, in the effect of histamine, which regulates the vascular system and increases permeability. It is assumed that the histamine stored in the pregnant uterus plays a part

in inducing labor pains and beginning parturition. However, there is no conclusive evidence to support this supposition. (EFFKEMANN). HILDA H. WULLEN.

Erving, H. W., Sears, C., and Rock, J.: Clinical Experiences with Equine Gonadotropic Hormone. *Am. J. Obst. & Gynec.*, 1940, 40: 695.

A gonadotropic substance obtained from the serum of pregnant mares has been used to stimulate ovulation in immature laboratory animals. It is reported to have produced ovulation and multiple ovulation in both the normal and abnormal human ovary, with gratifying results in cases of sterility, dysfunctional flow, and amenorrhea.

This study deals with a series of 48 cases of sterility, dysfunctional flowing, and amenorrhea which were treated with equine gonadotropic hormone. Sixteen patients were not ovulating, as proved by endometrial biopsy, and 9 others were not ovulating clinically. Twenty patients were ovulating, as shown by biopsy, and 3 were ovulating clinically. Effects of treatment were judged in 12 cases by endometrial biopsy and in the others by the subsequent clinical course. Thirty-nine patients (81.2 per cent) were apparently unaffected by equine gonadotropic hormone. In no case was there any definite evidence of the stimulation of ovulation by equine gonadotropic hormone. In the sterility group there was 1 pregnancy, but the authors believe it cannot be attributed to the equine gonadotropic hormone. An anovulatory patient was found by biopsy to be ovulating four months after treatment. One patient with dysfunctional bleeding continued to flow for a month following equine gonadotropic hormone therapy and since then has had amenorrhea for three months. Six patients with amenorrhea stained or flowed after treatment, but none of these showed evidence of ovulation. Only 1 patient continued to flow at regular intervals. She seemed to be responding rather to thyroid than to equine gonadotropic hormone stimulation. Allergic reactions to equine gonadotropic hormone appeared in 3 patients following therapy, and in 3 patients a cyst of the ovary was noted following treatment.

With the varying dosages used in this study, the equine gonadotropic hormone has not been shown to stimulate ovulation in women with anovulatory bleeding or amenorrhea, nor has it had any apparent effect in cases of sterility.

EDWARD L. CORNELL, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Young, J.: Relaxation of the Pelvic Joints in Pregnancy; Pelvic Arthropathy of Pregnancy. *J. Obst. & Gynaec. Brit. Emp.*, 1940, 47: 493.

Previous investigations have shown that pregnancy leads to a relaxation of the pubic joint which is reflected in an increase in the gap between the pubic bones. In some cases the gap is so great that it must be regarded as pathological. The widening commences some time in the first half of pregnancy and, in general, does not progress during the last two months. It is not increased by labor. The width of the gap diminishes after labor and approaches the prepregnant measurement by the end of the third to the sixth month. There is some evidence of a similar change in the sacro-iliac joint, but the anatomy of this joint makes it less amenable to accurate study. Some investigations carried out suggest the possibility of a hormonal basis.

The present evidence indicates that the degree of widening is on the average so meager that it can at the most have only a minor influence on the process of labor. The physiological softening of the joints may, however, facilitate the labor process in two different ways—by expansion of the pelvic space, and by allowing a rotary movement of the iliac bones. When the rotation is forward, it leads to an increase in the anteroposterior diameter at the brim, and when in the opposite direction, to an increase in the anteroposterior diameter at the outlet. The passage of the fetus itself helps to induce these favorable rotatory movements. Roentgenographic experiments with the Walcher position indicated that no appreciable increase in the anteroposterior diameter of the inlet resulted from it.

The disabilities arising from excessive relaxation of the pelvic joints during pregnancy fall under two headings: (a) those dependent upon an excessive mobility both at the sacro-iliac and the pubic joints; and (b) those dependent upon an excessive mobility at the sacro-iliac joint alone. Pubosacro-iliac arthropathy occurred 34 times in a successive series of 4,512 pregnant women, that is, 0.75 per cent. The investigations throw no light on the influence, if any, of age on the incidence of the condition. The average date of onset was the twenty-sixth week of pregnancy, the earliest date being the eighth week and the latest the thirty-sixth week; 13 patients were primigravidas and 19 were parous. The severity of the symptoms and signs is related to the degree of morbid movement which occurs at the loosened joints. The degree of the up-and-down gliding movement at the pubic joint can best be detected by roentgenography with the patient standing first on one leg and then on the other. In affected women, with marked symptoms, the movement is usually easy to detect.

Displacement at the pubic joint, whether widening or gliding, is correlated exactly with, and is dependent exactly on, the degree of movement at the sacro-iliac joint on one or both sides. The degree of widening of the joints does not bear a direct relation to the risk of disability, however. Routine examination of the pelvis for different purposes has revealed relatively wide separation without any clinical evidence whatever.

Trauma, of even trivial nature, may precipitate the disability in an acute and critical form. In 5 of 34 cases there was such a history. A certain proportion of patients date their symptoms from the trauma of labor, but rupture of the pubic joint during labor is extremely rare. This may occur especially in difficult and instrumental deliveries when the descending child pushes or drags down with it the two innominate bones, and causes them to rotate forcibly at their sacral articulations. Because of the trifling nature of the trauma in some cases, one must conclude that instances of this kind must involve joints which are damaged or are vulnerable because of a lowering of the tone of the surrounding muscles. This is supported by the fact that in 13 of the 34 cases the women were found to be suffering from some co-existing morbid process which, by general lowering of the health and the consequent reduction in the muscle and ligamentous tone, impairs the protective control of already weakened joints. The influence of postural strains incidental to pregnancy cannot be stated definitely, but it is the author's opinion that the standard of muscle tone is the paramount consideration.

While a morbid rocking of the superincumbent spine at one or both sacro-iliac joints is present in all cases of pelvic arthropathy in pregnancy it is not often possible to obtain evidence of this by either direct or x-ray examination of the joint.

The majority of the women exhibit the same basic clinical features, namely, pain and tenderness in the pubic and sacro-iliac regions, which first appear usually about the sixth or seventh month of pregnancy. Occasionally, backache may be absent. The symptoms generally develop gradually. In the beginning the patient is conscious of the discomfort only on walking or during any exertion. The symptoms may appear suddenly and acutely, however, after a sudden strain or accident. Walking or even standing may become impossible. In the majority of the cases there is an affection of the gait. In the milder ones there is a limp on one side, while in the more severe cases the patient may exhibit a well marked waddle. Tenderness on pressure over the pubic joint is one of the most characteristic physical signs. In addition there is tenderness on pressure over the affected sacro-iliac joint, and in some cases, there are pain and tenderness over the region of the sacrosciatic ligament.

The author believes that many women who develop backache some weeks or even one or two months after childbirth owe their disability to the damage of the pelvic girdle sustained during pregnancy or, in rare instances, during labor. Of the 30 women followed up after labor, backache of clinical importance was present in 14 or 46.6 per cent.

A larger group is represented by those with sacro-iliac arthropathy alone. This gives backache during pregnancy. However, it is only very rarely that we can substantiate this diagnosis by demonstrating, either by direct examination or by radiology, any evidence of displacement or movement at the joints, although it is the author's belief that in the large majority of cases of pregnancy-backache the symptoms and signs point clearly to sacro-iliac strain.

The treatment depends upon the severity of the symptoms. In the less marked cases the provision of a strong corset with curtailment of active exertion is sufficient. This should be continued for several months after the birth of the child. For all severe cases, complete rest in bed is the best treatment. After seven or ten days of such treatment the relief is usually well maintained if a corset is fitted before the patient gets up.

In the worst cases, about 1 in 10 of the total, the placing of the patient in a sling similar to that used for cases of fractured pelvis is essential. Massage, the application of radiant heat, and graduated exercises are all of value. The management of the patient during labor is important, especially during anesthesia, when the patient is unable to protect herself by the voluntary control of her muscles. Therefore, the pelvis should be supported at this time.

Under ordinary conditions, the pelvic joints, which are relaxed during pregnancy, lose their mobility within a few months after childbirth. It is possible that in those women whose symptoms persist this excessive mobilization persists in so far as the sacro-iliac system is concerned.

For chronic low backache of this type, manipulation has given the author better results than any other method of treatment. Twenty-five successive cases have been so treated. In all, the backache was traced to pregnancy or childbirth and there was no evidence of any other etiological factors. The method employed was that described by Bankart, in which manipulative movements directed to the forcible flexion of the lumbar spine and pelvis, forcible rotation of the sacro-iliac joint, and forcible extension of the lumbar spine and pelvis are carried out under anesthesia. In 17 of 25, or 68 per cent of the cases, the patients obtained complete relief from the backache. In the majority of successful cases the relief is immediate and sometimes astonishing.

DANIEL G. MORTON, M.D.

Nemec, E.: Ovarian Pregnancy (Eierstockschwangerschaft). *Bratislav. lek. Listy*, 1940, 20: 210.

Ovarian pregnancy occurs very rarely. Benecke described 100 cases prior to 1923 and Neumann described at least 40 more in 1932. The author's case was that of a twenty-seven-year-old married woman who had been sterile for six years. At laparotomy an ovary as large as a plum was found on the left side, and on that side of the abdomen was a 5 mm. opening from which villi protruded. Sections of this ovary revealed, beside the shell-like invaginated corpus luteum, an adjacent hematoma as large as a hazelnut with a pale membrane and chorionic villi. Microscopically, the hilus was hyperemic. In the ovary itself there were corpora albicantia and several atrophic follicles. The corpus luteum was markedly developed, its cells were exceptionally large, and the protoplasm was abundant revealing numerous yellow droplets. It was enveloped by connective-tissue fibers in which numerous blood vessels were found. Above this was a coagulum similar to the thrombus usually seen in the corpus luteum of pregnancy. In it were chorionic villi which penetrated the cortex and the corpus luteum in a stellate manner. In the ovarian stroma were larger blood vessels, into the walls of which chorionic villi had penetrated. Decidua or decidual reaction could not be recognized in the stroma although infiltrating chorionic villi were also present there.

The signs which are required by Leopold and Werth for confirmation of the diagnosis of ovarian pregnancy (free tubes and fimbria, and connection of the ovary by means of the ovarian ligament proper with the uterus and broad ligament on one side and by means of the infundibulopelvic ligament with the pelvic wall on the other side) could be determined beyond any question of doubt in the author's case.

Ovarian pregnancy can arise either on the surface (epi-ovarian) or within the follicles. Several opinions on this question were investigated (Seliga, Franz, Schikele, Beneke, Buettner, Hoehne, Kermauner, H. Kleine, and others). In the epi-ovarian pregnancy there is no spatial relationship with the corpus luteum, whereas in the intra-ovarian pregnancy the ovum lies in it. Several authors who deal with this question are mentioned (Miller, Millew, Kerrow, and others). Hoehne and Kermauner are cited in connection with intrafollicular pregnancy. The American investigators explain ovarian pregnancy on the basis of the Sampson theory (Webster, Lille, Sutton). A case of ovarian pregnancy was observed by Brouha and Robinson; the fetus was aborted by the traumatic action of an intra-uterine iodine injection. Some older opinions on this question are cited, those of Poorten and Opitz, as well as some of the newer opinions of R. Meyer, Caffier, Seliga, and others.

The author considered his case to be an intrafollicular pregnancy because of the condition of the corpus luteum. In one place the lutein-cell layer was very thinned out and in the neighborhood of the rupture it was lacking entirely. Such a condition is characterized by Miller as representing intrafollicular pregnancy. The treatment is always operative. (VILMA JANISCH—RAŠKOVIĆ). EDWARD W. GIBBS, M.D.

Oberst, F. W., and Plass, E. D.: Calcium, Phosphorus, and Nitrogen Metabolism in Women During the Second Half of Pregnancy and in Early Lactation. *Am. J. Obst. & Gynec.*, 1940, 40: 399.

It was the purpose of this study to determine the calcium, phosphorus, and nitrogen metabolism in pregnant women under dietary conditions which, at the present time, are believed to be nearly ideal for the growth and development of the fetus without depletion of the maternal organism of these elements.

A series of 21 ten-day calcium, phosphorus, and nitrogen balance experiments were made on 5 women between the twenty-first and the fortieth weeks of pregnancy. Three of these women were also studied during early lactation. The experiments were planned to obtain the maximum retention of calcium, phosphorus, and nitrogen during pregnancy. The results indicate that this end was accomplished. The daily calcium intake for the various subjects during pregnancy ranged from 1.63 to 2.64 gm., and the daily retention, from 0.23 to 0.88 gm. The calcium intake in 4 metabolic balances during lactation varied from 1.92 to 2.18 gm. with retentions varying from 0.02 to 0.51 gm. per day. The subjects with the highest milk excretion had the lowest retention. The daily phosphorus intakes during pregnancy ranged from 1.44 to 2.0 with retention from 0.022 to 0.68 gm. The daily phosphorus intakes in four periods during early lactation in 3 women ranged from 1.59 to 1.95, and the retentions from −0.18 to 0.21 gm. The negative balances shown by 2 women occurred shortly after parturition. The daily nitrogen intakes in 5 pregnant women ranged from 9.99 to 15.15 with retentions from −0.77 to 3.65 gm. The negative balance appeared in a subject who was ill during the collection period. The total nitrogen intake during early lactation ranged from 11.6 to 16.8 gm. per day. Two ten-day collection periods during the first and second weeks of the puerperium gave negative balances. Two other periods, one in the third and one in the fifth and sixth weeks of the puerperium, showed definitely positive balances.

Throughout the metabolic studies, the condition of the teeth was carefully observed since each subject had caries on admission. Periodic examinations of the teeth were made by a dental surgeon. In no case did new dental caries develop. In 1 case there was complete arrest of decay for the period of the study, and a consistent improvement in the teeth of all subjects was noted over the entire period of observation.

EDWARD L. CORNELL, M.D.

Cope, C. L.: Diagnostic Value of Pregnandiol Excretion in Pregnancy Disorders. *Brit. M. J.*, 1940, 2: 545.

Employing Venning's method of estimation of pregnandiol, Cope, of Oxford, reports analyses of twenty-four-hour urine specimens obtained from 100 cases of pregnancy, of which about 75 were seriously abnormal. Pregnandiol is found in the urine only during the luteal phase of normal menstruation, or when a placenta is actively functioning. In normal menstruation maximal excretion of pregnandiol occurs usually from five to seven days prior to the onset of bleeding. It disappears before bleeding starts unless pregnancy occurs. The daily excretion of pregnandiol is small during the first few weeks of pregnancy. It increases gradually, reaching its height in the eighth and ninth months, and falls to zero a few days after delivery. There is a wide normal variation in the daily amount of pregnandiol excreted.

Demonstration of pregnandiol in the urine in a case of amenorrhea is regarded as "strongly suggestive" of pregnancy. Conversely, absence of the substance from the urine of a woman with recent amenorrhea "usually means" that she is not pregnant. In regard to threatened abortion, Cope states that if pregnandiol is persistently absent at two or more determinations, this is very suggestive of one of three possibilities: (1) abortion is inevitable, (2) the products of conception have been already partially or completely evacuated, or (3) the fetus has died without expulsion and produced a condition of "missed abortion." Pregnandiol assays are of greatest value when intra-uterine death of the fetus is clinically suspected. Absence of pregnandiol provides "strong support" for the diagnosis.

The significance of a low pregnandiol excretion still remains uncertain. A normal excretion does not preclude the occurrence of abortion, nor does it connote a living fetus. Chronic nephritis and toxemia of pregnancy may both interfere with the excretion of pregnandiol. The author warns that the significance of pregnandiol analyses can be outlined only broadly at the present time.

WILLARD G. FRENCH, M.D.

Teräsvuori, H.: The Frequency and the Therapy of Placenta Previa, Including Local Statistics from Finland, from 1923 to 1932, and the Clinical Material from the Helsinki University Woman's Clinic from 1925 to 1936 (Zur Frequenz und Therapie der Placenta Praevia—Eine landes Statistik aus Finnland, 1923–1932, nebst einem klinischen Material aus der Univ.-Frauenklinik zu Helsinki, 1925–1936). *Acta Soc. Med. Fennicae Duodecim*, 1940, Ser. B, 28: Fasc. 1.

The author quotes an interesting array of statistics covering results obtained in Denmark and in Finland in cases of placenta previa treated by abdominal section, metreurysis, rupture of the bag of waters, and version. He stresses repeatedly that all cases of placenta previa should be hospitalized before hemorrhage or infection occurs. Even though labor at home, treated expectantly or with rupture of the bag of waters, appears to proceed satisfactorily, in placenta previa one never knows when the case may become an operative one because of dangerous hemorrhages. In difficult cases of this kind delivered at home the percentage of maternal mortality is very high. Those patients taken to hos-

pitals showed a lower death rate, but too many were brought in too late. First, the patient herself awaited the cessation of her hemorrhage; next, the midwife waited for the same; and, finally, the doctor waited. After all this waiting, hospitalization naturally did not show a satisfactory percentage of lives which were saved.

If circumstances require delivery of a case of placenta previa at home, early rupture of the bag of waters will help to expedite delivery and to reduce maternal mortality. If one is attempting to control the hemorrhage by tampons, and, if at the same time, the pressure against the cervical ganglia by the child's head increases the labor activities, the Willett-Gauss scalp forceps are of great service and often may replace version. If a version is done to stop hemorrhage in cases treated at home, the obstetrician should not attempt immediate extraction; this conservative method is indicated to avoid delivery before the proper cervical dilatation has taken place.

If the fetal life is in danger in total placenta previa, it is better to proceed by the extraplacental route than to perforate the placenta to reach the fetus. If the hemorrhage ceases, there is no urgent need for manual separation of the placenta; but if the mother is very anemic from the loss of blood and hemorrhage starts again, and if the Credé method fails, a manual procedure to deliver the placenta is in order. For mild cases, even in the clinic, the author advises rupture of the bag of waters. However, to avoid long delays in delivery and to circumvent continuous or recurring hemorrhage, the author finds it expedient to use the Willett-Gauss forceps, as no appreciable harm need be sustained to the living child by this method.

If the fetus is dead, the Clinic resorts to the classical therapy of placenta previa; this is version, which nearly always stops the hemorrhage.

The dangers of accouchement forcé in placenta previa were empirically so well defined, even before the era of cesarean-section, that forced dilatation of the cervix and extraction of the fetus cannot be recommended.

There are times when cervical dilatation has progressed so far that an experienced obstetrician can aid in a rapid delivery after version with the expectation of a living child. Otherwise, it must be admitted that with the exception of favorable results following rupture of the bag of waters, abdominal section, if conscientiously performed, is the only method that safeguards the life of the mother and the child.

The infant mortality could be reduced materially if the patient came for treatment in the hospital early instead of waiting for an ominous hemorrhage. If, after an accurate diagnosis (eventually also including a roentgen picture), one considers rupture of the bag of waters insufficient to expedite labor, then a cesarean-section should be done in the interest of both the mother and child, even before a vaginal examination is made.

If the mother is anemic a blood transfusion should be given.

Haugh of Denmark and Olow of Sweden are the only authors who presented reports of important examinations of large numbers of placenta previa cases. The author lists similar studies of statistics from Finland from 1923 to 1932, which include 1,498 cases of placenta previa. The frequency of this complication during those years is equal to 0.195 per cent (1 in 514). His research shows that there is a general increase in the number of cases of placenta previa cases; this is also proved by the statistics of the government, which have shown a definite increase since the beginning of the first decade of the twentieth century. This increase is due undoubtedly to the increase in the number of inflammatory diseases of the female genital organs just as this seems also to be the cause of the increase in tubal pregnancies.

In Finland about 56 per cent of the cases of placenta previa were delivered in hospitals. Those treated at home were for the most part less complicated cases with a maternal mortality of about 4 per cent; the institutional maternal mortality was about 6 per cent. The difficult cases treated at home showed a maternal mortality of about 10 per cent, while those treated in the hospital showed a mortality of about 8 per cent. The infant mortality of the cases treated at home was about 75 per cent; that of the hospital cases, about 43 per cent. The number of deaths due to infection was four times less than the number due to hemorrhages.

A comparison of the placenta-previa treatment prevailing in Denmark with that of Finland, with 14 per cent and 8.2 per cent maternal death rates respectively, leaves little doubt that the more frequent abdominal sections done in Finland account for the better results.

The author's conclusion is that if a case of placenta previa does not proceed with the labor after rupture of the bag of waters, abdominal section is the only method that will safeguard the mother and the child. The many complications of pregnancy and labor in the presence of placenta previa make individualization of the treatment obligatory.

MATHIAS J. SEIFERT, M.D.

Aigner, K.: The Frequency of Fetal Malformations in Conjunction with Placenta Previa (Die Haeufigkeit der fetalen Missbildungen in Verbindung mit Placenta praevia). *Zentralbl. f. Gynaek.*, 1940, p. 884.

The author quotes J. P. Greenhill's statement to the effect that fetal malformations are found much more often in connection with placenta previa than in cases not complicated by a low lying placenta, and with the evidence of 241,580 deliveries made at various institutions, among which there were 2,040 cases of placenta previa with 18 malformations he tests Greenhill's conclusion. Greenhill found a very high percentage of deformities in cases of placenta previa.

This comparatively high frequency of malformations in placenta previa might have the practical implication that the greatest conservatism should be practiced.

The author studied the cause of placenta previa and quoted all hitherto known theories. Some authors look for the etiological mechanism in the fertilized egg itself, others in the uterus; still others believe that placenta previa arises from a belated ripening of the egg. From the researches of Pootens the cause of placenta previa lies in the anatomically underdeveloped, poorly functioning endometrium. It is striking that placenta previa chiefly afflicts multiparas in whom the repeatedly functioning gravid endometrium is exercised and fatigued because of pregnancies following in rapid succession (Pankow). A placenta previa can also arise when implantation is successful in the face of conditions unfavorable to development. Placenta previa can generally be regarded as a complication of multiparity. An observation of Pankow shows that women in whom menstruation and ovulation have started late probably show a greater proclivity to the formation of placenta previa.

The author first divides fetal deformities into two groups: (1) those that occur because of faulty development (stunting of growth), and (2) those that arise from overdevelopment (doubling of parts); he then re-divides them into two other groups: (1) those which arise from the structural, abnormal, hereditary properties of the germ cell, and (2) those which represent secondary phenomena of disturbances of development.

The author enters into particulars of the causative developmental defects and reviews the results of experimental work to date. Fetal malformations can be precipitated by exogenous or endogenous factors. In this connection reference is made to the animal experiments in which malformations occurred. Among the endogenous factors, over-eating and over-producing ranked high. A rôle in fetal malformation is also played by disturbances in the hormonal pattern. Murphy concluded that most deformities depend upon damage to the germ-plasm. The author, on the basis of his researches, finally came to the conclusion, as other authors have, that miscarriages occur no more often in placenta previa than in cases with a normal placenta. He believes he can explain the variations between his results and Greenhill's on the ground that Greenhill arrived at his conclusions through an extremely irregular method and interpretation of data. Also, the author is not of the opinion that the cause of placenta previa and of malformations is generally the same. Exogenous influences very often instigate placenta previa; but it is difficult to prove exogenous influences to be the cause of malformations. Primary endogenous damage of the germ-plasm, at all events, plays a major rôle. Because of the fact that the frequency of malformations is not found to be greater in placenta-previa deliveries than in normal deliveries, there ceases to be any question whether this has any practical significance, i.e., whether the delivery is to be handled conservatively because of the fetal malformation. A common cause for placenta previa and fetal malformation has not been proved.

(RUDOLF HEEMEYER). RICHARD WARREN, M.D.

Westman, A.: Pernicious Vomiting of Pregnancy (Hyperemesis gravidarum). *Acta obst. et gynec. Scand.*, 1940, 20: 203.

During the period from January 1, 1925, to December 31, 1938, there were 66 cases of hyperemesis gravidarum, or 0.78 per cent of all the delivery cases seen at the Women's Clinic at Lund, Sweden during that time. Four patients had severe toxic symptoms, 9 had severe vomiting and pronounced vasomotor disturbances, 38 complained of severe vomiting only, and 15 had less severe vomiting, bordering on emesis gravidarum. Two of the 4 severely toxic women died. The autopsy findings were very slight. In toxic cases, Westman's clinic recommends induced abortion. In the other groups, treatment consisted mainly of withholding food, dextrose drop infusions, and insulin injections; later sodium chloride was given by mouth. Most of these patients who were checked for prolan elimination showed an increased urine prolan level. There was no relation between the severity of the hyperemesis and the prolan level.

In the discussion of this paper and papers by Brandstrup, Schøtt-Rivers, and Wetterdal, AHLSTRÖM stated that he never had a death from pernicious vomiting of pregnancy, nor had he ever induced an abortion for this condition. He uses psychotherapy, together with mild sedatives. His treatment consists of exercise and coercion, and of educating the patient to resist her vomiting reflexes. He does not keep his patients in bed. He places himself "in the line of fire," i.e., so that the patient would vomit at him, thus compelling her not to vomit. After a vomiting he forces a patient to eat solids immediately again.

ANKER discussed the hormonal aspects and reported his own research which, though not a final answer, should be read in the original by those interested in this aspect of the question.

OLOW reported that he had to perform operations three times to induce abortion in 137 patients with pernicious vomiting of pregnancy. In 2 patients who died (not of this series) there was cessation of the vomiting *sub articulo mortis*. His attempts with Vitamin B_1 are not yet conclusive.

HAUCH recommended treatment by complete isolation, enforced by withholding of mail and information that isolation will continue until vomiting stops. Along the same line of mental coercion, castor oil is used, to be repeated on repetition of the vomiting. Besides sedatives, he gives from 5 to 10 drops of epinephrine 1:1000, three times daily.

SUNDE stated that there is a very marked irregularity in the incidence of fatal hyperemesis: from 1906 to 1921, there were in his institution about 20,000 admissions and deliveries of pregnant women

without any death from hyperemesis; from 1921 to 1928, there were about 11,000 admissions with 5 deaths from hyperemesis; and from 1928 to 1939 there were about 22,000 admissions, again with no deaths from vomiting of pregnancy. He cannot explain this variation, but he compares it to similarly unexplained variations in mortality from eclampsia.

HEINRICH LAMM, M.D.

Mudaliar, A. L., Nayar, A. S. M., and Menon, M. K. K.: Eclampsia; A Clinical and Biochemical Study. *J. Obst. & Gynaec. Brit. Emp.*, 1940, 47: 404.

Biochemical investigations were carried out on 64 patients with eclampsia, on 103 with normal pregnancy of various durations, and on 12 normal nonpregnant women. The results are given in graphic form. The cases of eclampsia were divided into the renal, hepatic, and fatal types.

The average blood sugar in the normal pregnant woman, as has been shown before, is 64.48 mgm. per cent. In the hepatic and renal types of eclampsia the blood sugar was within normal limits, but in the fatal cases of eclampsia it was 59.6 mgm. per cent, a definite hypoglycemia. Therefore, insulin treatment is contraindicated. On the other hand, intravenous glucose therapy in these cases is now coming to the front more and more. A definite increase of the total sodium and potassium in the blood was found, so that one should think twice before large doses of alkalis are administered to eclamptic patients.

The serum magnesium in normal pregnancies was 1.51 mgm. per cent. In the fatal cases of eclampsia, it was 4.5. On the basis of these findings, one wonders whether magnesium sulfate should be used so indiscriminately. It would probably be best to restrict its use to those cases in which the magnesium is within normal limits.

An excess of phosphates was found, while the blood calcium was within normal limits. The diminished calcium-phosphorus ratio seemed to be of some prognostic significance. No conclusion could be drawn from the blood-cholesterol studies. A definite chloride retention was observed in the hepatic and renal types of eclampsia. Therefore, restriction of salt is considered advisable.

There seemed to be some retention of urea in the renal and fatal cases of eclampsia. The uric-acid values were high in the fatal cases. All investigators are agreed that a rise in the uric-acid content is of bad prognostic significance.

An average of 12.9 mgm. per cent of creatinine was found in the fatal cases, while the average for normal pregnancy was 2.89 mgm. per cent. An increase of blood creatinine is of very grave significance.

It was concluded that:

1. Hepatic eclampsia is rare, but it is fatal much more frequently than the other varieties.
2. Hypoglycemia is marked in the fatal cases, which suggests intravenous glucose therapy.
3. An increase of inorganic phosphorus, uric acid, creatinine, or of magnesium is of grave prognostic significance.
4. There is an increase of total bases in the blood and so alkalis should be carefully administered.
5. Hepatic eclampsia differs from the renal type in that there is an increase of magnesium, phosphorus, cholesterol, and uric acid with a practically normal blood-urea content and urea clearance.
6. The urea clearance is very much diminished in the fatal and renal types of eclampsia.

DANIEL G. MORTON, M.D.

Rauramo, M.: The Etiology and Treatment of Deflected Positions—a Critical Investigation Based upon the Author's Own Cases (Ueber die Aetiologie und Behandlung der Deflexionslagen—Kritische Untersuchung auf Grund eines eigenen Materials). *Acta Soc. med. Fennicae Duodecim*, 1940, Ser. B., 29: Fasc. 1, p. 1.

The author claims that the presentations of the anterior cephalic portion of the head, the forehead, and the chin at labor are the main problems of the European obstetricians. The descriptions of these positions are of historic interest and cover a period of years from 1100 A.D. to date. Many and varied designations have been applied to abnormalities of fetal positions during all these years. In the statistics found in the literature, these positions are classified and discussed separately by eminent obstetricians and even by some prominent midwives. Some of the latter are credited with surprisingly accurate descriptions of abnormal positions as well as commended for their treatments to overcome these abnormalities.

After giving about 40 pages of tables of births with all particulars included, such as age of the mother, number of children she bore, duration of labor, and time at which the bag of waters ruptured, the author states his conclusions. He gives a brief synopsis of the history that made known the abnormalities of the different groups of deflected positions, and reports certain theories covering the etiology of these positions as adopted at present. These theories are at great variance in many essential points etiologically, especially in the group of anterior cephalic positions, which are poorly explained. The author briefly states the prevalent treatment of deflected positions. The universal treatment of these deflections, including the chin presentations, is to adopt the expectant and watchful waiting procedure as far as possible in order to encourage spontaneous delivery or at least a delivery per vias naturales.

The many poor results of treatment should have led to certain therapeutic improvements in the interest of the babies. This has not happened even though the surgical technique has made immense progress. It is generally admitted that forehead and face presentations are often found concomitantly with contracted pelves. The author stresses the fact that in the general discussions of deflections only

certain features were studied, even though different grades of abnormal positions were obviously present; therefore, it was impossible to formulate authoritative conclusions on the problem. Comparing the different grades of deflections, etiologically and therapeutically on the basis of the various materials presented, with each other as well as with an entire group of deflections, the resultant false deductions are easily accounted for. Accordingly, the author believes it is indicated that the earlier results should be investigated from the standpoint of etiology, therapy, and final outcome of the treatments.

For this study he presents many statistics of his own 266 cases of deflection and of the comparatively few cases mentioned in the literature. Among the entire 1,135 deflections, there were 619 anterior cephalic presentations in 301 primiparas (49 per cent); 123 forehead presentations, in 54 primiparas (44 per cent); and 393 face presentations, in 165 primiparas, (49.9 per cent). A deflected position often results in forehead presentation when the soft parts offer great resistance, and in a face presentation when the soft parts offer less resistance.

As to age, 44.3 per cent of the primiparas of twenty-four years and younger and 50.4 per cent of the older mothers showed deflections.

A contracted pelvis caused 25 per cent of all the deflections in the author's own cases.

Babies weighing between 3,000 and 4,500 gm. are more frequently found in deflected positions than the smaller babies.

Twins in deflected positions were present in 4.6 per cent of all the hospital material.

Babies with an exaggerated fronto-occipital circumference cause more deflections than those of average measurements.

Sex apparently makes no difference in the occurrence of abnormal positions.

Congenital diseases, tumors, and anomalies of the extremities or of the cord, seldom cause deflections.

The causative factors of deflected positions are apparently similar in all groups of deflections. In the different groups and in the different cases these factors may operate separately or jointly in producing various degrees of similar abnormalities; therefore, the classification in daily practice would be better designated as Deflected Positions I and II, with 3 grades of modification.

Ptotic kidneys were present in 40 per cent of all the author's cases and in about 30 per cent of all their institutional cases. These kidney positions were due to constitutional infirmities, extremely hard muscular and overactive occupations, or protracted partus with long and severe labor pains which affected the entire circulatory system (all may have been influenced by contracted pelves).

The therapy in Viipuri is much different today from that in former years—there are many more surgical deliveries. The author describes the technique of his sectio caesarea isthmicalis and stresses its advantages: the corpus uteri remains intact, the incision is smaller, the danger of adhesions is less, the infections and thromboses are fewer, the risk of rupture of the uterus in subsequent labors is minimal, and the healing process is rapid.

Rauramo is of the opinion that all cases of deflection should be considered as one group for judging or comparing the treatment when the final results are obtained; otherwise the conclusions may easily be erroneous. Finally, he advocates early sectio caesarea isthmicalis when indicated, as the prognosis for mother and child is thereby greatly enhanced. MATHIAS J. SEIFERT, M.D.

LABOR AND ITS COMPLICATIONS

Vartamo, T.: Hematomas of the Vagina and Vulva in Connection with Labor (Ueber Vagina- und Vulvahaematome im Zusammenhang mit der Geburt). *Acta Soc. med. Fennicae Duodecim*, 1940, Ser. B., 28: Fasc. 3, p. 1.

Effusions of blood into the tissues arise generally as a result of an unusual trauma, mostly from the effect of direct force, and in women this is usually the process of labor, which makes great demands on the elasticity and firmness of the pelvic organs and tissues. In the literature, the frequency of the occurrence of these hematomas varies between 1:200 and 1:16,000. In primiparas hematomas occur three times as often as in multiparas.

Characteristic of these hematomas is their tendency to be restricted anatomically to certain areas filled with loose connective tissue and surrounded by firmer tissue, and to follow the direction of least resistance. Consequently most of the investigators divide the hematomas into those lying above and those lying below the musculo-fascial plate. Those above arise between the rectum and the vagina or between the cervix and the bladder, respectively, between the leaves of the round and broad ligaments. Below the plate the hematomas spread into the tissues of the vulva, the lower portion of the vagina, or into the ischiorectal fossa. The pelvic fascia serves as the limit, past which they generally do not spread. Only rarely, when there is great tissue destruction or especially marked hemorrhage, can the hemorrhage break through to spread into the upper tissues up to the subcutaneous tissue. The hematomas spreading upward may extend laterally toward the iliac fossa and then along the musculature up into the region of the diaphragm. Usually they are unilateral; very rarely they spread through the vesicocervical or the rectovaginal septum to the other side. Those arising below the pelvic floor generally do not spread so forcibly, but they rupture. They may reach a considerable size, even that of a man's head, but usually they are much smaller, nut-sized nodes, which swell the labia minora and majora into a single mass, or protrude through the anterior or lateral wall of the vagina into or out of the vulva. They are much more often on the left side than on the right, and this has been attributed to the asymmetry of the pelvic veins, as a result of which the veins on the left side contain more blood.

The most usual and striking symptom is pain, which is burning, cutting, or cramplike. Often the pains occur at intervals like labor pains and give a feeling of fullness in the pelvis. This symptom is especially characteristic for hematomas lying above the pelvic floor, in which cases an external swelling is often absent. Other neighboring viscera may also show signs of compression, such as urinary retention or strangury, swelling and bluish discoloration of the external genitalia from circulatory disturbance, and displacement of the uterus from the median line. Large hematomas may be associated with anemia as a result of the hemorrhage, which may rapidly become serious. If the effusion of blood spreads above the musculofascial plate, the picture may closely resemble that of an intra-abdominal hemorrhage.

The loosening of the tissues occurring in pregnancy is apparently a factor favoring the spread of a hematoma, but the opinions on the cause of the bleeding vary considerably. The various causes reported in the literature include a ruptured artery, and a torn varicose dilated vein, but most investigators consider the rupture of one of the larger blood vessels as the most common cause of hematomas. Either an accidental or individual weakness of the vascular wall is the most common prerequisite of a vascular lesion. Congenital or hereditary "inferiority" of the circulatory system, cavernous dilatations of the veins, varicosities, aneurysms of the uterine artery, nutritional disturbances of the blood vessels, and toxic injuries of the blood vessels have been considered responsible. All factors that increase the venous pressure are undoubtedly of special significance in the explanation of the genesis of hematomas. These include coughing, defecation, lifting heavy objects, and, especially, the powerful straining in labor. Another factor cited is the stasis of blood in the veins produced by the fetal head; this applies particularly to primiparas, in whom the collaterals of the venous system have not developed sufficiently.

The purely mechanical factors include the vaginal wall following the fetal head during the expulsive phase and its resultant separation from its substratum. A markedly anteriorly flexed uterus stretches the posterior vaginal wall during labor pains, resulting in hemorrhage before the head has reached this level. In protracted labor the fetal head produces a necrosis through pressure on the vascular wall, the separation of which causes bleeding. During an exceptionally rapid labor the tissues do not have time to stretch sufficiently, which results in a vascular rupture and a hematoma, especially when the pains and straining have been particularly severe.

Pelvic anomalies may also be a factor, especially the generally contracted pelvis with the attendant greater tissue tension, more marked compression, protracted labor, and numerous operative interventions. Forceps deliveries and versions may serve as trauma for weak vascular systems and lead to rupture. Anomalous positions of the fetus are frequent causes of hematomas.

Because of the fact that hematomas only exceptionally occur in successive deliveries, it may be concluded that no one constant factor is the main cause, or is alone decisive for the development of hematomas, but that the accidental factors are equally important. There are many causes and only when these concur in the same case do they produce hemorrhage into the tissues.

A hematoma rarely appears during the first stage of labor. Such an early appearance may constitute a serious obstruction to labor if the formation develops to large dimensions rapidly. Generally the hematoma appears only in or after the second stage and therefore does not interfere with labor itself. Hematomas have been reported as occurring relatively late in the puerperium.

Slight effusions of blood are usually resorbed within a few days without noteworthy injury. With large hematomas there is always the danger of hemorrhage and infection as a result of their rupture or, if they remain intact and circumscribed, the possibility of infection via the blood or lymphatic systems. Even if uninfected, an extensive hematoma may become a disturbing factor because of the resulting persistent and uninterrupted pain; or the hematoma may make the puerperal recovery more difficult mechanically by preventing the escape of lochia because of plugging of the vagina, thereby producing even severe symptoms of infection in the uterus.

The causes of death from hematoma are either the result of bleeding or infection. The prognosis depends essentially upon the extent of the hematoma; with small hematomas it is usually good. No definite conclusion can be drawn regarding the hematomas located above the musculofascial plate of the pelvis, as they may spread rapidly upward; but yet the hemorrhage may be so great as to cause death in a short time. If the hematoma ruptures externally, it may result in severe hemorrhage, which may persist and cause death in spite of packing and suture. Sepsis is extremely rarely a cause of death. The most serious and frequent cause of death is pulmonary embolism.

The prophylaxis is especially difficult because of the uncertain cause and the rarity of the hematoma. Rapid delivery must be avoided whenever dilatations of veins are observed. During all operative interventions crushing of the tissues should be avoided.

The treatment also depends upon the extent and localization of the hematoma. Small effusions of blood appearing after labor, which show no tendency to spread, require no operative measures, but a repetition of the hemorrhage should be avoided. For this absolute rest and an ice-cap, cold compresses, or lead water compresses are indicated. When the danger of extension is past, moist warm compresses and diathermy are used. If fever occurs later and an infection of the hematoma is suspected small hematomas are incised. The methods of treating larger hematomas vary considerably. When

the hematoma presents signs of further extension or has opened externally spontaneously, it is best to open the wound widely and carefully suture the cavity so as to avoid secondary hemorrhage and infection. This is best done in a hospital as the finding of a bleeding vessel may be very difficult; the procedure should never be considered as slight or simple. An early incision is the surest means of relieving the pain and effecting rapid cure. Hematomas localized above the musculofascial plate must always be treated surgically. For a very extensive hematoma and difficultly controlled hemorrhage, laparotomy is advised. When the hematoma appears early during labor the latter should be completed rapidly and carefully with forceps. If the hematoma is so large that the passage of the head is possible only by the use of great force and extensive tissue destruction is inevitable, a preliminary wide opening is recommended because in this way smooth wound surfaces are obtained and the after-treatment is facilitated. When a hematoma threatens to form an obstruction for the placenta, the latter must be removed manually. Credé compression should be avoided because this maneuver can easily spread the effusion of blood. In fresh cases with intact walls either conservative treatment or the incision, emptying and closure of the cavity, should be chosen. The incision should be made on the third or fourth day after the appearance of the hematoma because the danger of secondary hemorrhage is then lessened. LOUIS NEUWELT, M.D.

Fitzgerald, J. E., and Webster, A.: The Effect of Vitamin K Administered to Patients in Labor. *Am. J. Obst. & Gynec.*, 1940, 40: 413.

A series of cases has been studied in an effort to determine the effect of Vitamin K administered to women in labor. Control cases show practically no change in the maternal prothrombin during and after labor.

Patients treated orally with klotogen during labor show a definite rise in the maternal prothrombin level at the end of labor. There was also a definite rise in the average level of the cord blood. Patients treated with intravenous synthetic Vitamin K show approximately the same elevation of prothrombin levels.

A small series of patients who were given sodium pentobarbital as an analgesic showed a definite depression in the prothrombin level of both mother and child. This depression can probably be prevented by the proper use of Vitamin K.

EDWARD L. CORNELL, M.D.

Turunen, A.: The Use of Cesarean Section as an Obstetrical Method of Treatment in The Helsinki Woman's Clinic (Ueber die Verwendung des Kaiserschnittes als geburtshilfliche Behandlungsmethode in der Frauenklinik zu Helsinki). *Acta Soc. med. Fennicae Duodecim*, 1940, Ser. B, 29: Fasc. 1, p. 144.

Turunen finds that cesarean section has increased in his clinic since 1927 from 0.48 to 1.90 per cent. He classifies the indications for the intervention into four groups: narrow pelvis, nephrotic pregnancy, placenta previa, and other indications. The increase has occurred in all groups, but their percentage relations have changed: for instance, although the narrow pelvis is still the most important indication, it makes up only 59.6 per cent of the indications as against 75 per cent in 1927; while the other indications, especially the miscellaneous group have increased more rapidly. Asphyxia of the child due to various causes is an indication which has required consideration since 1927.

The maternal mortality from cesarean section has remained about the same—3.02 per cent. The worst results were obtained in the narrow-pelvis group and the most important causes of death were peritonitis and cardiac failure. There is no doubt that the mortality can be reduced by careful selection of cases, avoidance of cesarean section in dry or infected cases, more frequent use of Porro's intervention in infected cases, and the use of local instead of general anesthesia in unfavorable cases.

The increase in the number of cesarean sections in the four groups seems to have had a good influence on child mortality: there has been a decided decrease in the total mortality of all children (from 6.6 to 4.0 per cent) as well as in that of the delivered children (from 2.84 to 1.58 per cent). Therefore, it would seem that cesarean section in its present extension and if used according to the previous indications is capable of exerting a favorable influence on the results of delivery in his clinic.

Vaginal cesarean section was employed in 0.14 per cent of the cases, especially in detachment of the placenta, eclampsia, and other severe toxicoses, in which the fetus was already dead or was not viable. The maternal mortality was high (15 per cent) for reasons independent of the method of treatment. This intervention is recommended as less dangerous for the mother when the life of the child does not have to be taken into consideration. Sterilization at the time of cesarean section was undertaken in 11.03 per cent of the cases with the consent of the patient or of her husband. The percentage of repeated cesarean sections was 9.6; only 1 scar rupture occurred in a patient who had previously been operated upon elsewhere. RICHARD KEMEL, M.D.

MISCELLANEOUS

Embrey, M. P.: External Hysterography. A Graphic Study of the Human Parturient Uterus and the Effect of Various Therapeutic Agents Upon It. *J. Obst. & Gynaec. Brit. Emp.*, 1940, 47: 371.

Embrey, of the Welsh National School of Medicine, presents a hysterographic study of the behavior of the human uterus in labor and describes the influence of various therapeutic agents upon the uterus at that time. External hysterography is the method used, the apparatus being a modification of Dodek's and similar to that often employed by Moir. "It consists essentially of a levered cork

hammer impinging on the rubber diaphragm of a pneumatic chamber which is connected in turn in a closed-air system to a sensitive tambour writing on a recording drum. The pneumatic chamber and levered hammer are held in a four-legged support with a circular base which is applied to the maternal abdomen overlying the distended uterus." The working principle of the apparatus depends on the fact that during each uterine contraction the antero-posterior diameters of the uterus and the maternal abdomen increase. "This causes an upward deflection of the hammer which produces, via the diaphragm, corresponding compression of the air column which is transmitted to the tambour and recording mechanism."

Embrey states that many individual studies were made. Sixty graphic illustrations are presented. His conclusions were as follows:

"The general anaesthetics, gas and oxygen, ether and chloroform, in small amounts produce satisfactory analgesia without depressing the uterine activity. In larger amounts they depress the uterine contractions in direct proportion to the depth of anaesthesia produced.

"The commonly employed analgesics and sedatives—potassium bromide and chloral hydrate, morphia, and morphia and hyoscine—exert little or no depressing influence on the uterus in labour, and their main value lies in the obliteration of pain and the increased tranquillity produced.

Of the oxytoxics, quinine is undependable; pituitrin and its oxytocic principle, even in small amounts, markedly stimulate uterine activity, but have the disadvantage that they tend to produce a condition of incomplete tetany; thymophysin is less reliable than pituitrin and has no advantages over it; oestrin and acetylcholine quite definitely stimulate the parturient uterus in a proportion of cases, though not so dramatically as pituitrin."

WILLARD G. FRENCH, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Foley, F. E. B.: The Surgical Correction of Horseshoe Kidney. *J. Am. M. Ass.*, 1940, 115: 1945.

The anomaly of horseshoe kidney presents a definite clinical problem. It is the problem of what may be called horseshoe kidney disease as distinct from disease of the horseshoe kidney.

A horseshoe kidney not affected by pathological change apart from the anomaly may be productive of symptoms demanding relief. Surgeons have failed, with few exceptions, to accord this relief and apparently have failed to contemplate doing so.

Surgical correction of the anomaly by division of the isthmus and nephropexy on one or both sides is capable of restoring the normal relationship and relieving the subjective symptoms caused by the anomaly.

Any outspoken pathological change in the horseshoe kidney that is wholly responsible for the symptoms present, provides the same clear-cut and definite indication for correction that the same lesion would provide in a normally formed kidney.

For the present purpose, all cases of horseshoe kidney may be divided into three groups and commented upon as follows:

Group 1. Cases of horseshoe kidney without renal pathological change or symptoms of renal origin. In the majority of cases in this group, urological investigation is prompted by painful abdominal symptoms of other than renal origin. In a large minority of cases the investigation is prompted by the patient's own discovery of an abdominal mass, or by the physician's similar discovery.

Since the horseshoe kidney is not affected by pathological change, and causes no symptoms, there is no more reason for surgical intervention than there is for intervention in the presence of an undiseased and symptomless kidney of any form.

Group 2. Cases of horseshoe kidney with outspoken renal pathological changes and symptoms of renal origin. Under competent medical care and modern methods of urological diagnosis most cases in this group are clinically recognized, both the anomaly and associated lesion being clearly demonstrated. In most instances the associated lesion presents the same diagnostic and surgical problems that the same lesion would present in a normally formed kidney. In the combination it may be difficult or impossible to say what part of the syndrome is caused by the lesion and what part by the anomaly. Unless there are good indications to the contrary it may be best to assume that the associated lesion is responsible, then correct it surgically, and leave the anomalous relationship undisturbed. Should an unsatisfactory result ensue, the anomaly should be investigated, and if good indications are found the anomalous relationship should be corrected by division of the isthmus and normal positioning of the separated kidneys.

Group 3. Causes of horseshoe kidney with symptoms of renal origin but without renal pathological change other than some degree of pelvic dilatation. There is reason to believe that a large number of horseshoe kidneys belong to this group and yet, with few exceptions, nothing has been done about them.

If symptoms are present the burden of proof goes with saying that they are not caused by the horseshoe kidney. These symptoms may be referable to the urinary tract or may be vague and indefinite. In the literature, particularly in the monograph by Gutierrez, are found reports of cases with pyelograms showing no deformity, apart from the anomaly, but presenting either symptoms typical of renal origin or vague symptoms possibly of renal origin. If comprehensive investigation fails to disclose an extrarenal lesion capable of causing the vague symptoms, then there is much reason to believe that the symptoms will be relieved by correction of the anomalous relations, by division of the isthmus, and nephropexy on one or both sides.

As to the proper clinical management of horseshoe kidney, the chief conclusion to be drawn is that the anomaly of horseshoe kidney not affected by any concomitant pathological change of significance may be productive of painful and other symptoms, and of insidious development of renal disease, and normal anatomical relations can be restored with relief of the symptoms and arrest of the insidiously developing renal disease by appropriate surgical intervention—symphysiotomy and nephropexy.

JOHN A. LOEF, M.D.

DeTakats, G., and Scupham, G. W.: Revascularization of the Ischemic Kidney. *Arch. Surg.*, 1940, 41: 1394.

Four patients with hypertension in whose cases the diagnosis of malignant nephrosclerosis was made were operated on with the idea that the ischemic kidney might obtain some additional circulation. The kidneys were decapsulated, the cortex was incised, and the omentum or a pedicled muscle flap was wrapped around the kidney. The 4 case reports are summarized. One patient has been followed up for three and one-half years. In no patient was there definite improvement.

It is possible that if patients with essential hypertension with earlier or more proximal vascular damage were subjected to such a procedure the condition might be arrested or improved. The importance of taking renal biopsy specimens and the difficult interpretation of biopsy observations in the early stages are emphasized. For the late stages, in which the patient is referred to the surgeon, renal vascularization has been of no value whatever.

JOHN A. LOEF, M.D.

Kosic, H.: The Action of Posterior Pituitary Extract on Human Ureteral Peristalsis (Die Wirkung der Hypophysenhinterlappenextrakte auf die Ureterperistaltik des Menschen). *Zentralbl. f. Chir.*, 1940, p. 1119.

The author studied the peristaltic stimulating action of extract from the posterior lobe of the pituitary gland and the peristaltic inhibiting action of "spasmolytica" on ureteral peristalsis of healthy human urinary systems with the aid of cystoscopy and intravenous pyelography and ureterography and reported the following results:

The heretofore usual intramuscular and subcutaneous injections of extract from the posterior lobe of the pituitary gland proved to be ineffective in stimulating ureteral peristalsis, in contrast to the intravenous injections, which in smallest dosage produced no unpleasant complications, and were of reliable effect.

In the discussion it was indicated that the intravenous method of administration of the drug for the removal of impacted ureteral stones should be abandoned as there is great danger of perforation of the ureter by the impacted stone because of the stimulated ureteral peristalsis. No condemnation of subcutaneous or intramuscular injections was made.

(NEUPERT). STANLEY ROBBINS, M.D.

Jewett, H. J.: Stenosis of the Ureteropelvic Juncture; Congenital and Acquired. *J. Urol.*, 1940, 44: 247.

A study of 71 cases of hydronephrosis has established 3 fundamental causes of obstruction at the upper end of the ureter: (1) bands and kinks, 4 cases (5.6 per cent); (2) accessory renal vessels, 24 cases (33.8 per cent); and (3) stenosis, 43 cases (60.5 per cent). In the group of cases in which stenosis was the underlying cause of obstruction, secondary accelerating factors were accessory renal vessels, infection, kink and fixation, high ureteral insertion, and, possibly, rapid renal growth during puberty.

In the majority of normal cases there is no line of demarcation between the renal pelvis and the ureter. Any deviation from the normal funnel-shaped, pyelo-ureteral outlet is probably pathological. Deviation of a moderate degree, sufficient to cause only minimal obstruction, can be compensated for by work hypertrophy of the pelvic musculature.

When the ureter is normal, a sharply defined and permanently persistent ureteropelvic junction, in the presence of pyelectasis, should be considered obstructive. D. E. MURRAY, M.D.

Rusche, C. F., and Bacon, S. K.: Injury to the Ureter Due to Cystoscopic Intra-Ureteral Instrumentation. *J. Urol.*, 1940, 44: 777.

After a comprehensive study of the medical literature dealing with the problem of injury to the ureter due to intra-ureteral instrumentation, we are able to state that the relative infrequency of reported cases is due to the failure to recognize that the ureter has been injured. Slight hematuria or clot protrusion from a ureteral meatus has been observed not infrequently following the introduction of a ureteral catheter. This amount of trauma may render the ureter inelastic and susceptible to greater damage at subsequent catheterization if carried out before the process has had sufficient time to heal. Indwelling ureteral catheters may cause this same change temporarily. The extreme resistance to perforation of the normal ureter has been studied adequately by Wesson. In his original investigation Wesson states that "a normal ureter cannot be punctured by a catheter" and "it is doubtful if a diseased ureter can be perforated unless a deep ulcer is present." Since the advent of so many instruments designed to assist the passage of or to extract ureteral calculi, the incidence of ureteral injury has increased. Foley recognizes the value of these instruments, when properly employed, in the removal of very small stones. The application of any forceful maneuver at the site of impaction may rotate a rough stone and cause perforation through the adjacent area of disease. Injection of a urographic medium in several instances has completed the perforation through the diseased and traumatized area.

The treatment of a perforated ureter is usually incision and drainage of extravasated urine. In some instances the tissues withstand local infiltration and the inflammatory process heals completely. More frequently, a virulent retroperitoneal extravasation results because of bacterial invasion and calculus occlusion of the distal portion of the ureter. Removal of the impacted calculus should be attempted unless the patient has progressed into an unsatisfactory state. If the calculus is in the distal portion of the pelvic ureter in the female, vaginal incision and drainage of the retroperitoneal space, identification of the ureter, and removal of the calculus are suggested. At the Los Angeles County General Hospital, from January 1, 1928, to March 31, 1939, 19,459 cystoscopic examinations have been made. Among these there have been 10,597 bladder observations and 8,862 ureteral catheterizations (unilateral or bilateral). Our survey of these records discloses, cases of simple trauma being excluded, the incidence of 12 cases of definite injury to the ureter during instrumentation; however, in 1 of the 12 the tip of an instrument was broken off in the ureter and did not perforate its wall. In their private practice the authors have had 3 cases of ureteral perforation following instrumental manipulation.

The authors conclude that intra-ureteral instrumentation causes ureteral injury usually when there is impaction of a calculus and adjacent disease of the ureter. The present increase in incidence of ureteral perforation is related closely to the recent development of many devices designed to remove calculi. The treatment of a perforated ureter usually consists of incision and drainage of the extravasated urine and removal of the calculus. Fourteen cases of ureteral injury and 2 cases of foreign bodies in the ureter due to cystoscopic instrumentation have been reported. JOHN A. LOEF, M.D.

Hepler, A. B.: The End-Results of Uretero-Intestinal Implantation. *J. Urol.*, 1940, 44: 794.

The operation of vesical exclusion by transplantation of the ureter to the sigmoid or rectum was performed in 27 patients with 2 deaths, a mortality of 7.4 per cent.

When the operation is done for the congenital deformities seen in children, exstrophy and epispadias without a vesical sphincter, the results, both immediate and late, are excellent. There were 16 patients in this group with no postoperative deaths. All of the children are living and well except 2.

When it is done for the acquired lesions of adults, such as carcinoma of the bladder, intractable tuberculous or interstitial cystitis, or inoperable fistulas, the damage to the upper urinary tract secondary to these conditions adds to the operative risk and modifies the functional results. There were 11 patients in this group with 2 postoperative deaths, a mortality of 18.3 per cent. There were 4 late deaths, all but 1 of which were from extension of the primary disease and could not be attributed to the ureteroenterostomy. The earlier use of this operation would make it a truly conservative procedure and not a last desperate means to relieve intolerable bladder symptoms.

One of the chief considerations in a successful outcome is the avoidance of obstruction of the ureter at the site of the anastomosis, and to this end the simple methods which avoid a too-tight infixation of the ureter in the submucosal gutter seem to be the best. Many of the elaborate methods devised to avoid complications seem only to invite them.

In the presence of upper urinary-tract lesions the diseased and abnormal ureters add to the technical difficulties and increase the risk of implantation. However, in some cases in which relief is imperative one should not be too easily sidetracked from a contemplated uretero-enterostomy by the dogma that abnormal or dilated ureters should never be transplanted. It is surprising at times what good results are obtained under adverse circumstances.

JOHN A. LOEF, M.D.

BLADDER, URETHRA, AND PENIS

Knight, F., Uhle, C. A. W., and LaTowsky, L. W.: The Treatment of Gonorrheal Urethritis in the Male with Sulfathiazole. *J. Urol.*, 1940, 44: 748.

Fifty-five cases of gonorrheal urethritis in the male are the basis for this report. Of this number, 50 were followed up to the finale of either cure or failure.

The classification of gonorrhea in the male which was used in this study is that of Eisendrath and Rolnick. Of the 55 patients who presented themselves to the authors' clinic for treatment there were 34 with acute anterior urethritis, 18 with acute posterior urethritis, 2 with subacute anterior urethritis, 1 with subacute posterior urethritis, and none with chronic urethritis. Of the 48 patients who were eventually cured with sulfathiazole, 5 had epididymitis, 1 a periurethral abscess, and 1 inguinal adenitis before therapy was begun.

The diagnosis of gonorrheal urethritis was based on the history, clinical symptoms and signs, and positive bacteriological studies. These bacteriological studies consisted of a smear and culture of the urethral exudate in every case. All stains were done by the Gram technique.

The patients were seen twice a week during the early stages of treatment and later at intervals of one or two weeks. At each visit the customary urological examinations were made, and bacteriological work was done at appropriate time intervals. The blood levels of sulfathiazole were ascertained for almost every patient.

In the beginning of the study it was decided to keep the dosage as uniform as possible and to continue treatment until the patient had been free of discharge for one week or until the urine had become clear in both glasses. Since the authors were dealing with ambulatory patients, it was elected to give dosages compatible with the normal activity of the patient. All of the patients received the drug in divided doses, usually 3 times a day. Of the 48 patients cured with sulfathiazole, the majority received 3 gm. daily for four days, while others required 3 gm. daily for twenty-eight days. The total dosage required to effect a cure ranged from 12 to 48 gm. and averaged 28 gm.

The provocative tests were begun when clinical symptoms had ceased and the urine had remained clear for three or four days. These tests were begun early because of the type of patients with which the authors were dealing. Most of the patients had a tendency to default when they began to feel that they were improving. The following consecutive tests were required of a patient before he could be discharged as cured: (1) alcoholic indulgence; (2) passage of a sound into the urethra; (3) prostatic massage, and smear and culture of the prostatic fluid; (4) examination of a condom specimen; and (5) prostatic massage, both smear and culture of the prostatic fluid to be negative for gonococci on 2 or more occasions.

The results of treatment are summarized as follows:

Of the 50 patients followed up, 48 (96 per cent) were cured as shown by satisfactory reaction to all the criteria of cure, and 2 (4 per cent) were not cured. The results of treatment were uniformly good, no matter what the existing pathological condition was at the time treatment was begun. The average number of visits to the clinic before cure was complete was 6, with a range from 3 to 14. Two cases were failures. Both of the individuals in these cases failed to coöperate during the treatment period.

There were no complications in any of the cases during the period of treatment.

The effect of sulfathiazole on the erythrocyte count, hemoglobin, leucocyte count, differential count, and electrocardiographic studies showed no significant changes. JOHN A. LOEF, M.D.

Kyrle, P.: Malignant Melanoblastoma of the Urethra (Zur Kenntnis der malignen Melanoblastome der Harnroehre). *Ztschr. f. urol. Chir. u. Gynaek.*, 1940, 45: 287.

Malignant new-growths of the urethra are usually carcinoma; the sarcoma is of the greatest rarity; only about 40 instances have been reported. The author has had the opportunity to observe 2 such cases. In a woman of fifty-three years of age a bluish-gray pedunculated polyp, the size of a plum, was located at the orifice of the urethra. It was easily removed and histologically proved to be a melanosarcoma. In the second case a brownish-black pigmented tumor could be traced into the tissues of the wall of the urethra for a depth of 1½ cm.

Two forms of this new growth are to be distinguished,—the mucosal sarcoma and the mural, or parietal sarcoma. The female sex is more frequently attacked. In the male the sarcomas which have been observed have given the impression of being a tumor of the penis and have usually led to the removal of that organ. Apparently these sarcomas develop from pigmented moles, since the location is unusual and no cells of the nature of an anlage for the development of melanotic pigment are found at this point. The 11 cases, reported in the literature which was available to the author, are appended in tabular form.

In the 2 cases operated upon by the author results have so far been good; however, the time is still too brief for prognosis. A group of other patients died within the first eight months from metastases. Subsequent roentgen irradiation was not consistently carried out. Consequently the prognosis is doubtful as late metastasis may develop, even after many years.

(Roedelius). John W. Brennan, M.D.

GENITAL ORGANS

Moore, R. A., Miller, M. L., and McLellan, A.: The Urinary Excretion of Androgens by Patients with Benign Hypertrophy of the Prostate. *J. Urol.*, 1940, 44: 727.

Upon the basis of logic, an endocrine disturbance may be due either to a quantitative change in the rate or amount of secretion of hormones, or to a qualitative alteration in the hormones. Thus in hypogonadism of men, the clinical results of replacement therapy indicate that there is a simple reduction in the amount of effective androgenic substances. On the other hand, in a case of adrenal virilism Butler and Marrian isolated an abnormal androgenic substance.

Morphological studies furnish strong inferential evidence that benign hypertrophy of the prostate is related to the endocrine function of the testis and pituitary. In 1938, the authors undertook to collect data on the hormonal status of patients with benign hypertrophy of the prostate. The studies up to the present time may be divided into 6 phases: the urinary excretion of androgens; the urinary excretion of estrogens; the chemical nature of the urinary androgens; the respiration (Warburg) of prostatic tissue and the effect of hormones; the chemical composition of prostatic secretion and the effect of hormones; and the anatomical and physiological state of the pituitary gland in patients with benign hypertrophy. In each of the investigations an attempt was made to contrast three groups of individuals, normal young adult men, men over forty years of age with benign hypertrophy of the prostate, and men over forty years of age without clinically demonstrable disease of the prostate. This report is concerned with the first of the above phases, the urinary excretion of androgens by the three types of individuals.

As a control for the observations in older men, 6 three-day specimens of urine from 5 normal young adult men between the ages of twenty and thirty-five were collected and assayed.

All results were recorded in the equivalent of international units of androsterone per day. As noted in the discussion of the methods, this represents about one-half the value reported by Koch, but the discrepancy can be accounted for by the difference in the method of hydrolysis.

Urinary androgens in older men without benign hypertrophy of the prostate. Although it is extremely difficult to detect by rectal palpation the earlier stages of benign hypertrophy, a group of 5 men who showed no demonstrable evidence of disease of the prostate were selected for this phase of the study.

Urinary androgens in older men with benign hypertrophy of the prostate. These men in every instance showed clinical evidence of urinary obstruction and had been admitted to the hospital for a prostatectomy. There were 12 three-day specimens from 7 patients. In 1 man, 4 successive three-day specimens of urine were collected and accurately assayed and variations in the amount of androgens were found.

In the following table the maximum, minimum, and average results in the three groups of patients are summarized:

TABLE I.—THE EXCRETION OF URINARY ANDROGENS (IN INTERNATIONAL UNITS OF ANDROSTERONE PER DAY)

Type of patient	Average	Maximum	Minimum
Young men	19.4	25.3	10.3
Older men without benign hypertrophy	9.0	16.6	6.1
Older men with benign hypertrophy	6.7	15.3	2.2

The difference in the amount of urinary androgens in young adult men and in the older men with or without benign hypertrophy of the prostate is definite. Only 1 specimen (No. 28) from a young man had a value below the highest value for the older men. Similarly only 2 specimens (Nos. 22 and 1) from older men had a value above the lowest value for young men. We may therefore conclude with a reasonable degree of certainty, that with

increasing age in man there is a corresponding decrease in the urinary androgens which are biologically active. Comparison of the values for the two groups of older men, one with and the other without benign hypertrophy does not give a sharp difference. Although the average values are 9.0 and 6.7 international units, the degree of overlapping of the figures is considerable. Thus 4 of 12 specimens from men with benign hypertrophy contain less androgens than any of the 5 specimens from men without benign hypertrophy. It may be tentatively concluded, therefore, that the amount of urinary androgens in older men with benign hypertrophy is lower than in men of a similar age without clinically demonstrable disease of the prostate. The values for successive specimens from 1 patient with benign hypertrophy are insufficient to warrant definite conclusions. They do indicate, however, that there is as much variation in older men as was observed by Koch in young men.

An evaluation of the significance of these results in an explanation of the etiology and pathogenesis of benign hypertrophy of the prostate must await further observations. If the general theory of the blocking effect of androgens on estrogens be accepted, it is possible that the decrease in androgens allows the estrogens to act on the prostate. Most of the specimens reported upon in this paper have also been assayed for estrogens, but the methods used were not sufficiently accurate to warrant discussion here. Newer and more accurate procedures have been developed in the last year and the results will be published later. At that time, it will be possible to calculate the androgen-estrogen ratio and to evaluate the decrease of urinary androgens in older men, especially those with benign hypertrophy of the prostate.

The authors conclude that there is a decrease in the amount of urinary androgens in older men as compared to young men. The decrease is apparently greater in men with benign hypertrophy of the prostate than in those free from disease of the prostate. The interpretation of these findings must await further investigation. JOHN A. LOEF, M.D.

Nesbit, R. M.: The Treatment of Prostatic Obstruction. *New England J. Med.*, 1940, 223: 481.

The author attempts to clarify the much discussed treatment of prostatic obstruction. He concludes that the selection of operation for benign prostatic hypertrophy must depend on the experience and technical skill of the individual surgeon, it probably being true that in equally skillful hands the suprapubic operation carries a higher mortality than do the other methods, and that the perineal and transurethral operations have a comparable mortality.

All three operations when skillfully performed can be expected to produce excellent results, although in the author's hands the transurethral operation shows to advantage over suprapubic prostatectomy. Urinary incontinence and rectal injury, which occasionally complicate perineal prostatectomy even in the most skillful hands, are not to be expected in either the suprapubic or the transurethral operation.

From the standpoint of the patient, properly performed transurethral resection shows to advantage over the open methods of prostatectomy in those factors of comparison which interest him; that is, he has a more comfortable and more ambulatory postoperative period, his period of hospitalization is shorter, and his functional results are at least as good.

It is the author's opinion that the advantages of transurethral prostatectomy make it the operation of choice for benign hypertrophy, whenever it can be properly performed. He believes that the size of a benign gland does not constitute a criterion for or against resection except in relation to the skill and dexterity of the individual surgeon. The accomplished resectionist must recognize his own limitations and select the operation with a full and honest recognition of those limitations. Transurethral resection has a place in the armamentarium of every urologist; the degree of its usefulness, like that of the other methods of prostatectomy, depends on the skill and judgment with which it is employed.

D. E. MURRAY, M.D.

Scott, R. T.: Torsion of the Appendix Testis. *J. Urol.*, 1940, 44: 755.

The appendix testis or hydatid of Morgagni is a vestigial structure representing the cranial end of the muellerian duct. It has been called the nonpedunculated hydatid of Morgagni in contradistinction to the pedunculated hydatid of Morgagni, or appendix epididymidis. However, it is probably pedunculated as often as it is non-pedunculated, which accounts for its liability to torsion. That torsion of this appendix testis may produce a very painful and disabling lesion has only been appreciated in comparatively recent years.

Several small embryonic remnants, the seat of pathological lesions, are located within the scrotum in close relationship to the testis and epididymis. Of these the appendix testis is most liable to pathological changes. It lies between the upper pole of the testis and the epididymis; it is about 0.5 cm. in diameter and is usually pedunculated. Occasionally, however, this appendage may attain considerable size. Histologically the appendix testis consists of vascular connective tissue in which are irregular canals lined by columnar epithelium.

The exact cause of torsion of the appendix testis is no more clearly understood than torsion in other organs possessing a pedicle. Apparently infection plays no rôle. Since torsion may occur during sleep, violent muscular contractions do not appear to be a factor. The outstanding symptom is pain. This is usually severe and unaccompanied by any degree of shock. The pain may be relieved spontaneously only to come on again in other attacks. There is little or no elevation of temperature and urinary disturbances are usually absent. There may be a moderate degree of hydrocele present which prevents accurate

palpation of the scrotal contents. McFadden states that the most significant symptom is edema and redness of the scrotum. This is always present and is out of all proportion to the minuteness of the lesion. If the patient is seen several days after onset, the edema will have subsided and a small pea-sized mass may be palpated at the upper pole of the testicle. Palpation of this mass is usually not possible during the acute stage. There is no alteration of the relationship between the cord and testicle.

Expectancy should play no part in the treatment of this condition, since operation is simple and without risk, and recovery without surgery requires more time than with it. In addition, detorsion may occur and the individual may thus experience repeated attacks of torsion. Undoubtedly many of these cases are not recognized and drag out a long and painful course before recovery ensues. Randall advises that both sides be operated upon at the same time as the pedicle of the opposite side will usually be found to be elongated. If expectant treatment is employed recovery will require from two to three weeks. Recovery following operative treatment should not require more than from five to seven days.

JOHN A. LOEF, M.D.

Ewell, G. H., Marquardt, C. R., and Sargent, J. C.: End-Results of the Injection Treatment of Hydrocele. *J. Urol.*, 1940, 44: 741.

The principal objection to treatment of hydrocele by injection has been the possibility of overlooking co-existing pathological conditions such as cancer or tuberculosis, or the injection of the quinine solution into the peritoneal cavity in cases of congenital hydrocele. The authors still believe that with care exercised in the taking of the history and in physical examination, these possibilities can be reduced to a minimum. When the possibility of such co-existing pathological processes exists, operation always should be advised. The danger of the introduction of infection can be obviated by proper care in the technique. The authors have never recommended the method as a minor procedure, although the treatments may be given in the office, dispensary, or in the operating room of the hospital on an ambulatory patient.

Most authors in discussing the surgical treatment of hydrocele are prone to minimize the questions of recurrence and infection. Young, in his recent article, points out clearly the danger from hemorrhage following the Winkleman operation and proposes his operation to obviate this danger. He mentions also the disadvantages of Andrews' bottle operation. That recurrences do occur following surgery will be shown by the statistics.

Some writers refer to such annoying sequelæ as painful contracture, lobulated collections of fluid, and adhesions which follow the injection of a strong irritant solution into the tunicary sac. The authors point out again that the quinine solution which they used differs radically from the solutions previously used, such as iodine and phenol, and while any chemical solution not isotonic in nature is irritating when injected into any body cavity, they question the term "strong irritant" when applied to the quinine urethane solution.

In the follow-up examinations of these cases, they did not observe a single case of painful testicle or painful retraction of the testicle. Neither were there lobulated collections of fluid. There were no cases of atrophy of the testicle. Small epididymal cysts were commonly found and they occurred about as often on the opposite untreated side. In most cases, some slight tunicary thickening was demonstrable. If the quinine solution was inadvertently injected into the tissues outside the tunicary sac, pain and swelling followed. This happened in the authors' cases but sloughing never occurred, and the swelling and induration gradually subsided.

In this series of cases of hydrocele and spermatocele, some of the patients are still under treatment or have been followed for a few months to seven years. Their ages ranged from three months to eighty-six years. The amount of fluid varied from a few to 1,650 c.cm. The patient with 1,650 c.cm. of fluid required 6 treatments and has remained cured for more than two years. The duration of the hydroceles varied from a few months to seventeen years. The average number of treatments has been 3. Quinine and urethane have been used in all except 6 cases in which sodium morrhuate was used; its use has been discontinued.

The authors conclude that the injection treatment of hydrocele and spermatocele with quinine hydrochloride and urethane solution is a safe and effective procedure and in the vast majority of cases consider it to be the method of choice.

JOHN A. LOEF, M.D.

Gilbert, J. B.: Studies in Malignant Testis Tumors; Syndrome of Choriogenic Gynecomastia. *J. Urol.*, 1940, 44: 345.

One hundred and twenty-nine cases of gynecomastia associated with malignant testicular tumors are analyzed. Six personal cases are added, which make a total of 135 cases. This total is subdivided into 2 groups.

Group 1 includes the 103 cases of gynecomastia associated with teratoid tumors. These 103 cases include 54 primary testicular tumors, 7 so-called extragenital chorio-epitheliomas (in 4 of which the testes were incompletely examined), 11 apparently misdiagnosed chorio-epitheliomas, and 31 teratoid tumors with a clinical course strongly suggesting the presence of chorio-epitheliomatous elements.

Group 2 comprises 2 personal cases and 18 cases from the literature which were eliminated from discussion in the group of true choriogenic tumors with gynecomastia. The breast stimulation was nonfunctional, and not related to the testis tumor.

The characteristics of the syndrome of choriogenic gynecomastia with testis tumors consist of:

1. Chorio-epithelioma in the primary or metastatic tumor.

2. Gynecomastia, usually bilateral, with glandular-tissue hyperplasia which is often the only clinical symptom present.

3. Enlargement and hyperpigmentation of the areolas usually occurring together.

4. Physiological activity manifested by either gross or microscopic secretion in the breasts.

5. High titers of choriogonadotropic (luteinizing, Prolan B) hormones and the presence of folliculin (estrone).

6. Histological changes in the pituitary gland described generally as "pregnancy cells."

7. Hyperplasia of the prostate and of the seminal vesicles—generally of both—is frequently found.

D. E. MURRAY, M.D.

MISCELLANEOUS

Alyea, E. P., and Roberts, L. C.: Chemotherapy in Non-Specific Infections of the Urinary Tract. *J. Am. M. Ass.*, 1940, 115: 1345.

Revolutionary changes in the treatment of infections in the urinary tract have been made, and an attempt is made by the authors to review the newer drugs in the urological armamentarium and to specify as nearly as possible specific drugs for specific treatment of bacterial infections in the urinary tract. They question the prophylactic use of pre-operative medication, and conclude, from their personal experience, that:

1. The sulfonamide drugs are excreted by the kidneys in a manner exactly similar to phenolsulfonphthalein.

2. *In vitro* and *in vivo* studies show the specificity that the sulfonamide drugs have for different bacteria and different strains of the same bacterium.

3. Experimental studies *in vitro* are not necessarily entirely comparable *in vivo*.

4. The action of sulfonamide drugs in infections of the urinary tract depends more on the tissue reaction than on direct bactericidal action in the urine.

5. Mandelic acid is an excellent drug for infections with the colon bacillus and streptococcus fecalis.

6. Colon-bacillus infections treated with sulfanilamide and with sulfapyridine show practically the same proportion of cures, 81 per cent.

7. In staphylococcic infections sulfapyridine produces cure in 75 per cent of the cases and sulfanilamide in 62.5 per cent.

8. The response to sulfonamide drugs is rapid, usually within two or three days.

9. Infections complicated by other pathological changes do not respond as favorably as the simple infections.

10. A comparison of sulfanilamide and mandelic-acid therapy in various types of cases shows that sulfanilamide is usually preferable.

11. The high drug concentration in the urine, usually thought desirable, is not necessary for cures.

12. A dosage of 1.8 gm. of sulfanilamide a day with fluids forced, produced as good results as did 3 gm. a day with restricted fluids. The same is true of sulfapyridine.

13. Many patients cannot take the large doses with restricted fluids, but the recommended small dosage is tolerated by all. D. E. MURRAY, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Seddon, H. J., and Strange, F. G. St. C.: Sacro-Iliac Tuberculosis. *Brit. J. Surg.*, 1940, 28: 193.

Sacro-iliac tuberculosis is essentially a disease of young adults, 80 per cent of cases occurring between the ages of sixteen and thirty-five. This distinguishes it from all other forms of joint tuberculosis.

There is little difference in sex incidence. Of 176 patients, 85 were males and 91 females.

There are three distinct clinical types: (a) an isolated lesion without sinuses—33 per cent of cases; (b) an isolated lesion with sinuses—31 per cent of cases; and (c) a lesion, with or without sinuses, but found associated with tuberculous lesions elsewhere —36 per cent of cases.

Abscess formation is exceedingly frequent, occurring in 72 per cent of the cases, and usually the pain subsides when the abscess develops. In 44 cases pain was a prominent symptom and at no time did an abscess develop. In 49 cases pain was present at first, but ceased when an abscess developed. In 43 cases pain and abscess were coincidental.

Sinus formation is also frequent, occurring in 42 per cent of cases. In 53 cases sinuses complicated an apparently isolated joint lesion. In 21 additional cases, with more than one manifest lesion, sinuses were also present over the sacro-iliac joint.

Tuberculous lesions found in association with sacro-iliac disease are frequent; they were present in more than one-third of the cases, and were sometimes multiple. The author emphasized the fact that the associated lesions were all clinically obvious and it is possible that a higher incidence would have been revealed by the routine investigation of the lungs and the kidneys.

The most common sites for associated lesions are the lungs and joints, particularly the lumbar spine.

Erosion of the joint surfaces is the most common roentgenographic finding; para-articular cavitation of bone is not infrequent.

Prognosis as to life depends chiefly on the clinical type of the disease. The mortality rate over a six-year period is as follows: closed isolated lesions, 10 per cent; isolated lesions with sinuses, 25 per cent; lesions associated with tuberculous foci elsewhere, 55 per cent. After six years the mortality rate is almost negligible.

Recovery generally means that the patient will be able to return to work with full capacity, and relapse is rare. A certain amount of chronic invalidism is due to sinuses.

Pregnancy does not cause relapse, provided that the disease has healed soundly.

Bony ankylosis is probably the usual end-result of conservative treatment, even in the absence of secondary infection.

The principles of conservative treatment are well known and should be followed in every case. In order to obtain good results the time element must not be considered.

Operative fusion of the joint may be beneficial, but its merits have not yet been clearly demonstrated. The best field for operation is not in curing the disease, but, as a final procedure, in converting unsound fibrous ankylosis into stable bony fusion.

The average period of hospitalization is eighteen months, and is not materially altered by operation.

NORMAN C. BULLOCK, M.D.

Gill, A. B.: Legg-Perthes Disease of the Hip; Its Early Roentgenographic Manifestations and Its Cyclical Course. *J. Bone & Joint Surg.*, 1940, 22:1013.

The author employs the name Legg-Perthes disease of the hip inasmuch as no adequate pathological term has been suggested, and since the name "Legg-Waldenström-Calvé-Perthes disease" is too cumbersome.

The onset of symptoms has been observed in children between the ages of three and eleven years, and 85 per cent have been boys (a contrast to the sex incidence of congenital dislocation). Tuberculin reactions have been consistently negative and the blood sedimentation rate has been normal. In a few cases a definite history of injury, immediately preceding the onset of symptoms, was obtained, but more frequently such a history was lacking. A few cases showed definite evidence of endocrine imbalance, but this cannot be accepted as an etiological factor unless it is proved in all cases.

The author's present conception of Legg-Perthes disease is that it follows a primary aseptic necrosis in the metaphysis that is due to an interference or blocking of the blood supply. The cause of this obstruction is yet unknown. The degenerative changes that occur in the head are also in the nature of aseptic necrosis which follows alterations in the blood supply through the metaphysis and epiphyseal plate. The deformities that arise in the head and neck are due to a mechanical crushing of the necrotic tissue which is caused by weight-bearing and muscle pull. Deformity of the acetabulum is dependent upon the altered shape and position of the head.

The disease is often far advanced at the onset of symptoms. These initially are limp and pain, which is most commonly felt in the knee. Symptoms may not be continuous and they may frequently disappear after rest in bed for a few days. On first examination there are limitation of motion, particularly that of rotation of the femur, and definite, firm thickening of the hip. Occasionally there is slight wasting of the muscles of the thigh.

The striking and uniform feature is an early necrosis in the metaphysis of the neck of the femur

that may be made to stand out more clearly by slight overexposure of the roentgenograms. The areas of decalcification vary in number, size, shape, and location. Most commonly they first appear at the outer margin of the neck or in the center, less frequently at the inner margin. Occasionally they may be large and conical, resembling an infarction, with the base against the epiphyseal plate. As time passes they multiply, enlarge, coalesce, and finally form a broad band of decalcification across the entire metaphysis. Waldenström's sign is almost always positive.

The concomitant or subsequent degenerative changes that occur in the head of the femur, directly overlie the first area of necrosis in the metaphysis and as the disease spreads in the metaphysis, it extends correspondingly in the head. This suggests that the degeneration of the head is the result of the necrosis in the neck. Irregular areas of decalcification enlarge and leave isolated areas of increased density which produce an appearance of fragmentation. This may progress until the remains of the head are barely visible.

This phase of degeneration and disintegration extends through a period of about a year and a half. It is prolonged by lack of treatment and shortened by adequate care.

The change in cycle between degeneration and regeneration can be noted in successive roentgenograms taken at two-month intervals. Regeneration is usually apparent in the metaphysis before it is apparent in the head. The decalcified areas in the neck disappear as new bone forms. Then recalcification appears in the head. The metaphysis will be restored to its normal appearance a long time before regeneration of the head is complete.

The fact that regeneration first occurs in the metaphysis and is completed there first, again points to the conclusion that the changes that occur in the head are dependent upon the primary changes in the metaphysis. The time required for complete regeneration of the head is approximately from two to three years.

The diagnosis is easily made when the pathological process is fairly well advanced, but it is attended with some difficulty in the very early stage. Careful comparison of the suspected and uninvolved hip, by a moderate overexposure of the roentgenogram will reveal the appearance of necrosis in the metaphysis. This is so constant that the author is unwilling to make a roentgen-ray diagnosis of Legg-Perthes disease without its presence.

The author also stresses the value of careful palpation with the hip grasped between thumb and fingers so as to detect the slight difference in thickness between the two hips. A slight but firm thickening can almost always be felt in Legg-Perthes disease; this contrasts with the more marked, soft thickening appreciable in early tuberculosis of the hip.

Whenever possible, the child is put to bed with Buck's extension on both legs and is kept in bed until regeneration is well advanced. The child is then allowed to go about with a walking brace with a perineal crutch, a high shoe on the well leg, and crutches. When these requirements can be carried out without interruption, the end-results are practically perfect hips. Full weight-bearing is not permitted until regeneration is well advanced.

Photographs of more than 70 roentgenograms illustrate the discussion of cases and furnish visual evidence of the diagnostic points that the author stresses. HOMER PHEASANT, M.D.

Cozen, L., and Greene, W.: Congenital Equinovarus. *West. J. Surg., Obst. & Gynec.*, 1940, 48: 697.

The authors studied 96 cases of club-foot. Sixty-one of these were bilateral, while the unilateral cases were equally distributed, there being 18 on the right and 17 on the left side. The authors separated the cases for study into groups, based on factors such as age, date of institution of treatment, severity of the deformity, and the degree of parental coöperation. These cases were treated by many methods and by all members of the Orthopedic Staff of the Children's Hospital in Boston, between the years 1924 and 1930. Nine tables together with appropriate illustrations depict the graded results in each group.

The authors are not didactic in their statements, as they admit that the many variables reduce their findings to opinions rather than facts. They are properly severe with themselves in their definition of a recurrence, stating that it is any return of the equinus, inversion, or adduction after its having been absent on a prior date. The following conclusions represent the essence of their findings:

1. Almost any form of accepted treatment will bring about an improvement, but none will produce permanent satisfactory results without careful and frequent check-up and diligent coöperation of the parents in carrying out the home program of treatment.

2. Excessive atrophy of the calf can be prevented by preventing recurrence of the deformity and thus avoiding the necessary long periods of rigid plaster immobilization.

3. Shoes for club-foot are overrated as a factor in successful treatment. JAMES K. STACK, M.D.

Scherb, R., Francillon, M. R., and Burckhardt, E.: Foot Disorders in Military Service (Fussbeschwerden im Militaerdienst). *Schweiz. med. Wchnschr.*, 1940, 2: 701.

There is a current fallacious theory that in those foot deformities and disturbances belonging to the large group of cases of incomplete flat-foot and hallux valgus, the condition can be cured by placing a support in the shoe. The pathogenesis of foot disorders is of an extremely complex nature and cannot be explained on a purely morphological basis. A classification of foot disorders is at present impossible. It has been shown that the study of foot deformities must include a study of musculocinetic relationships

and their disorders. Every foot deformity constitutes an individual problem which requires an individual solution. A routine prescription for arches or supports is impossible. Since mobilization, all these complex problems have become acute and demand extensive revision. These findings are based on experiences in the Department of Military Sanitation VI, and in the army. The disturbances vary greatly in degree and do not always correspond to the degree of deformity. A person with severe flat-foot may be quite capable of military service, whereas some slight deformity may completely incapacitate another person for this strain. The authors present a brief review of the lesions under consideration.

If there is complaint of foot pain, and an objective and subjective sensibility to pressure can be demonstrated on the mesial side of the scaphoid, an os tibiale externum may be suspected. The roentgenogram will be the determining factor. In this condition, as in the rare os trochleare on the external side of the calcaneus, arch supports will be of no benefit and only extirpation will afford relief. Circumscribed painful areas of the short muscles of the foot may often suggest foot deformity, but are, as a rule, only a result of overexertion. Such painful areas are not unusual even in a normally shaped foot. Pain is felt in the abductor hallucis, the interossei, the quadratus plantæ, and the abductor digiti quinti muscles. Now and again these areas may be confused with calcaneus spurs. In the differential diagnosis one must also consider beginning chronic inflammatory processes of the ligamental apparatus of the foot and chronic monarthritis. Also a beginning arthritis deformans must be considered.

The authors then proceed to give a brief review of the various deformities of the foot. In primary, osteogenic, incomplete flat-foot, the neck of the talus is far forward, so that the medial series of tarsal bones and the first metatarsal are not curved in an arch but lie flat, parallel with the substrate. Besides this flattening of the talus, there is also a wedge shape with its base medial, and a wedge shape with a plantar base. A short résumé of myogenic weak arches and flat-foot and of contracted cases follows. The variety of foot disorders taught in the postgraduate courses was small, but active service has brought about considerable changes. For prophylactic purposes it has been decreed that digging assignments should be interrupted regularly by marching assignments. Diagnostically the army doctor has little difficulty. For this reason it is ordered that orthopedic patients in various army units are to be examined and balanced once weekly by specialists. At this station a certain classification is effected of cases that can be treated here and cases that will have to be sent to the Department of Military Sanitation. The revision of orthopedic council into larger societies is still too new to permit a report of experiences.

The authors are of the opinion that soldiers requiring arch supports should be sent to a Department of Military Sanitation where special doctors and suitable apparatus for proper treatment are available. As regards prescription for supports, the following points should be observed:

1. The arch is intended to support the foot, which entails the necessity of having it placed in the shoe in such a manner that it cannot slip.

2. As broken arches usually require a supportive propping up of the os calcis, the supporting arch should begin not under the Chopart's joint but under the corpus calcanei. At the level of the scaphoid the arch of the inlay should bulge somewhat.

3. If the plantar cushions of the metatarsal heads II and III are painful, these pains may also be treated by inlays, but the support must be placed directly beneath the heads, and the inlay must not be too short.

4. The shoe must not slide over the inlay. In military patients simple supports with steel spring inlays may often be used. The inlay must fit the shoe. A discussion of footgear would take us too far afield.

If it is desired to help a flat-footed person to walk comfortably with arches, protective training is indicated. Muscular weakness may be treated by massage and counter-irritation of the periosteum with antiphlogistic compresses and ointments. The inlays should not be planned for immediate maximum correction, but should be gradually brought to this point. Inlay treatment is a distinctly individual procedure. Surgical interventions are rarely indicated (skeletogenous changes in the shape of the talus and scaphoid, which are treated with wedge resections). In hallux valgus, the two-thirds resection of the basal phalanx of the great toe, according to Brandes, is best.

(Schweizer). Edith Schanche Moore.

FRACTURES AND DISLOCATIONS

Guleke, N.: Gunshot Fractures of the Long Bones in the Vicinity of the Joints (Ueber die gelenknahen Schussbrueche der Roehrenknochen). *Deutsche Mil. arzt*, 1940, 5: 257.

In his time Franz demonstrated by gunshot experiments that the splintering of the diaphyses of the long bones following injury by infantry missiles did not, as a rule, extend beyond certain limits, disregarding, of course, more extensive fissures. These limits were given as from 11 to 13 cm. for the thigh, from 8 to 9 cm. for the upper arm, from 10 to 11 cm. for the lower leg, and from 4 to 6 cm. for the forearm. Guleke draws attention to the fact that the conditions are different for the metaphyses. In metaphyses of similar shape, as in the lower end of the upper arm, radius, thigh bone, and upper and lower ends of the tibia, one finds besides the actual zone of comminution, extensive fissures reaching up to or even into the joint. One frequently encounters Y or T fractures either because of fine fissures or cracks with or without displacement of the condyle. The clinical diagnosis as to whether or not the joint

is involved is often impossible. This decision can be made only after stereoscopic roentgenographic examination or from roentgenograms in at least two planes. In the presence of infection there is the risk of the infection involving the fracture; this usually follows, but not necessarily.

Guleke then emphasizes the difficulty of diagnosis, for this secondary infection does not, as a rule, manifest itself in acute inflammatory swelling or emphysema, but usually develops insidiously as a capsular phlegmon. This fact, as well as the fact that one can frequently aspirate no pus on puncture in these cases, is little known. Even experienced surgeons may be misled thereby. The patients gradually fall victims to an insidious sepsis, the symptoms of which are readily overlooked by the physician in daily attendance because he attributes them to the badly infected fracture. Diagnosis is imperative, however. For this purpose an early exploratory arthrotomy through a small incision is recommended, on the basis of the author's own experience. One may then frequently be astonished to find a dirty, purulent joint cavity without much exudate, with fistular tracts into the surrounding tissues and the greatly feared fistular abscesses. In such cases the popular small button-hole incisions afford drainage and permit irrigation, nothing more. It is necessary to make large incisions through the entire capsule. However, if this does not bring rapid results, one has no alternative but typical or atypical resection. Thereafter the joint cleft must be kept wide open by longitudinal traction.

The illusion that a fresh infection of the bone may be caused by sawing the bone under such septic conditions has been refuted by experience. Nor has Guleke ever observed a progressive suppuration in such sawed-bone surfaces. One is constantly surprised at the rapidity with which the latter are covered with good granulations and also, if the resection has been properly timed, at the speedy recovery of the patient.

As regards the indication for resection or amputation, it is not the severity of the intervention that is to be the determining factor, but the consideration as to whether the patient is in a condition to weather the longer morbidity associated with resection. With hemostasis and blood transfusion, resection *per se* is not such a serious intervention; but it must be done early. In the presence of a chronic even though apparently mild course of the general infection, resection done after six weeks is usually too late. Amputation is indicated only when the general condition of the patient is such that resection with subsequent morbidity would seem unjustifiable or when no marked improvement has followed resection within ten to fourteen days. The fact that so many surgeons shun resection is attributable, according to Guleke, to the fact that it has been little used in present day peace-time surgery. The war surgeon has need of it, however, and should be trained for it by regular courses in operating upon the cadaver. Such training is also indispensable for the treatment of the frequent gunshot injuries of the blood vessels and should be included in the peace-time curriculum of the student and in postgraduate courses.

(Franz). Edith Schanche Moore.

Key, J. A.: The Treatment of Complete Fractures of Both Bones of the Forearm. *Surg. Clin. North Am.*, 1940, 20: 1393.

A series of 8 patients, each of whom was suffering from fractures of both bones of the forearm in which the fragments were displaced, was presented with brief case histories. Each of the patients was treated by one individual and each patient presented a slightly different problem.

The most satisfactory results were obtained in the first and second cases presented. The first was seen immediately after the accident and in this one a satisfactory but not anatomical result was accomplished by manipulation; the second was seen three days after the accident, and in this it was possible to obtain a satisfactory but not anatomical reduction after much difficulty. The next most satisfactory results were obtained in Cases 6 and 7, in which open reduction was performed.

The least satisfactory results were obtained in 2 cases in which wire traction with a mechanical reduction apparatus had been used. The result in Case 5 was also unsatisfactory in that the author was content with a fair reduction by conservative means. He believes that a better result would have been obtained in this case by prompt open reduction with adequate internal and external fixation.

In the last case, in which there was severe damage to the soft parts, he had a satisfactory result, when one considers the type of injury which was present.

Key believes that if a satisfactory and stable reduction cannot be obtained by a competent surgeon at the first attempt in fractures of both bones of the forearm, open reduction and internal and external fixation should be resorted to if a competent surgeon and adequate facilities are at hand. For internal fixation he prefers small stainless steel-wire loops. The sprinkling of a small amount of sterile sulfanilamide powder in the wound before it is closed has greatly decreased his fear of infection after open reduction. External fixation is, in his experience, best obtained by means of long posterior and short anterior padded wood splints which are encased in a plaster-of-Paris cast. The cast extends from the middle of the arm to the bases of the fingers and is so cut out in the palm that free exercise of the thumb and fingers is possible.

Emil C. Robitshek, M.D.

Zollinger, F.: Statistical Studies of Leg Fractures During 1933 and 1934 (Statistische Untersuchungen ueber die Unterschenkelfrakturen der Jahre 1933 und 1934). *Ztschr. f. Unfallmed. u. Berufskrkh.*, 1939, 33: 259.

Of 3,036 cases of leg fracture, 2,883 were reviewed for type of treatment and comparisons were made with various earlier statistics. The exact statistical

material must be read in detail in the original articles as only the most significant results are presented here.

The average treatment required ninety-three and seven-tenths days; the average period of disability was eighty-seven days. Amputations, pseudarthroses, and combination injuries were not included. However, the survey includes not only shaft fractures, but also malleolar fractures, as well as fractures of one or both bones. Among the industrial fractures 73.7 per cent healed without, and 26.3 per cent with residual invalidism, requiring insurance or permanent disability payments.

The author followed this general survey with results of the special types of fractures:

I. In 1,106 isolated fractures of the external malleolus the average duration of disability was from forty-four to sixty-two days. Walking casts required a definitely shorter period than circular casts. An invalidism of 8 per cent was noted.

II. In 188 isolated fractures of the inner malleolus the disability lasted from forty-six to seventy-five days. The same results were obtained from treatment as in Group I. Invalidism resulted in 22 per cent.

III. In 258 fractures of both malleoli the disability lasted from sixty-six to one hundred and fifty-nine days. Traction required the longest time for treatment; walking casts required the least time. Invalidism resulted in 43 per cent.

IV. In 390 fractures of the fibula the disability lasted from twenty-nine to sixty days. Invalidism resulted in 6 per cent.

V. In 254 fractures of the tibia the disability varied from forty-four to two hundred and thirty-three days. The majority were treated with circular plaster casts, very few with walking casts, so that a comparison is not possible. There were 3 deaths and 1 case of pseudarthrosis; invalidism resulted in 23 per cent.

VI. In 555 shaft fractures of both bones the disability lasted from one hundred and three to one hundred and ninety-five days in the cases which were not operated upon, and two hundred and thirty-four days in the 35 that were. Invalidism resulted in 57 per cent. Traction and circular casts were employed about equally. Unna paste boots and walking casts were seldom used. Operative treatment required the longest time (234.29 days); then traction (195.13 days); and then circular casts (143.46 days). The observation of Ostermann that traction required a longer time is confirmed here. Comparisons were made with the statistics of several other authorities. There were 6 deaths, 16 amputations, and 26 pseudarthroses.

VII. In 26 cases of fracture of the head of the fibula the disability lasted from forty-three to forty-nine days; invalidism resulted in 14 per cent.

VIII. There were 67 fractures of the head of the tibia with 1 amputation. Disability lasted from sixty-three to one hundred and ninety-three days; invalidism resulted in 56 per cent.

IX. There were 10 fractures of head of tibia and fibula. The disability lasted from one hundred and thirty-nine to two hundred and fifty-three days. All patients were invalided.

X. There were 119 fractures of the inner malleolus with fracture of the shaft of the fibula. Disability lasted from sixty-three to one hundred and sixty-seven days. Traction required the longest time; walking casts took the least time. Invalidism resulted in 39 per cent.

XI. Operative treatment was given in 61 cases, or 2.2 per cent. In this group alone were encountered 35 cases of shaft fracture of both bones. For the most part Lane plates were used.

Traction was utilized in only 10 per cent of all the malleolar fractures, and was usually obtained by use of a Kirschner wire. The author stated that such treatment required a longer time and was used for greater disabilities than the plaster or metal splints.

A special study of compound fractures established no greater morbidity. It was merely stated that there were 173 cases (6.2 per cent).

(Franz). Jerome G. Finder, M.D.

Bode, F.: Failures Following Open Reduction of Fresh Fractures and Their Lessons (Die Fehlheilungen blutig eingerichteter frischer Frakturen und ihre Lehren). *Arch. f. orthop. Chir.*, 1940, 40: 285.

The indications and avoidable errors of open reduction treatment are discussed on the basis of a perusal of the performances of 70 colleagues. The old conservative method is the usual procedure. On the other hand, operative procedures are preferable at present in any group of fractures. Indications must be strictly followed.

Operation should be undertaken at the opportune time since delayed intervention makes the prognosis less favorable. Efficient control of pain is essential for closed reduction, inasmuch as reflex muscle resistance under certain conditions makes correction impossible and thereby leads to unjustified operations on fractures. Interposition of the soft parts only rarely makes open operation imperative, but it is necessary in compound penetrating fractures after successful débridement. In ankle fractures the diastasis of the ankle must occasionally be corrected by suture. The necessity of suturing patellar and elbow fractures with wide diastasis is generally recognized. Open operations must be considered in fractures of both bones of the extremities. Rarely is it necessary in intra-articular fractures of the head and through the surgical neck of the humerus. In cases of nerve injury in which it is necessary to expose the nerve, the fractured fragments may be engaged or mechanically fixed at the time of operation. Laminectomy is indicated only when bone splinters exert pressure on the spinal cord. If the spinal cord merely "rides" on a fragment of a vertebral body laminectomy is unnecessary. Here non-operative treatment is preferable.

Compound fractures are managed according to the fundamentals of wound treatment. The use of foreign material in bone suture is to be avoided. Wound infections following open operation are unfortunately still frequent. It must be recognized that the condition of fresh or recent fracture wounds, with regard to implantation and further growth of bacteria, offers a better possibility of the development of accidental wound infection than the tissues in their normal condition. The most favorable time for operation lies between the eighth and tenth days after the injury. Bony union is the measuring rod for the effectiveness of the asepsis of the operative method. V2A-steel is employed as basic suture material. A number of practical hints on technique are offered.

The experiences gathered from these performances are summarized and the significant points are:

For the majority of fractures conservative treatment is the usual procedure. Only when reduction cannot be achieved in this manner is operative treatment indicated. Strictest indications should be observed and recorded in writing for the medical history. Slight lateral displacement of the fractured fragments offers no indication for open reduction if the normal weight-bearing line of the fractured fragments is retained within reasonable limits. Soft-part interposition, apart from the interposition of nerves, rarely offers an indication for open reduction. The closest attention should be given to asepsis, technique, and gentle handling of the tissues. Foreign material should be used sparingly. Wire often fails to hold firmly and therewith brings about conditions unfavorable for bony union. Bone suture makes an immobilizing plaster bandage imperative.

In conclusion it may be said that the results of operative treatment of fractures are by no means satisfactory up to the present time. The number of failures is considerable. The failures cannot be charged to the methods used but primarily depend on the manner in which they are carried out.

(Nestmann). John L. Lindquist, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Gage, M., and Ochsner, A.: The Prevention of Ischemic Gangrene Following Surgical Operations upon the Major Peripheral Arteries by Chemical Section of the Cervicodorsal and Lumbar Sympathetics. *Ann. Surg.*, 1940, 112: 938.

A normal peripheral circulation (arterial, venous, and lymphatic) is dependent on several factors, among which a residual arteriovenous pressure, capillary pulsations, and sympathetic balance are important. The sudden occlusion of a major peripheral artery disrupts the normal physiological processes concerned with maintaining a normal circulation distal to the point of obstruction. Consequently such a vascular accident frequently but not always results in ischemic gangrene.

The prevention of the development of ischemic gangrene following the sudden occlusion of a major peripheral artery is dependent upon the establishment of an adequate collateral circulation. The functional capacity of the collateral circulation varies according to the site of the obliteration, obliteration of the common femoral carotid artery at its bifurcation and of the popliteal arteries being frequently followed by grave consequences. As the collateral vessels are under control of the same sympathetic system which controls the main artery, any disturbance, direct or reflex, within the main arterial stem affects the collaterals secondarily.

A review of the literature shows that the incidence of ischemic gangrene following the sudden occlusion of a major artery varies between 5.2 and 45.8 per cent and that these figures are dependent not only on the mechanism (trauma 11 to 48.5 per cent, ligations for aneurysms 5.2 to 15 per cent, and embolism averaging over 30 per cent) but also on the location of the obstruction. Various investigators found the incidence of gangrene in the extremities following injury to the main arterial trunks to range between 11 per cent (Kretzschmann) and 40.2 per cent (Tuffier). Statistics illustrate that the incidence of gangrene is higher when the lower extremity is involved than when the upper extremity is involved. It is likewise brought out that the closer the obstruction is to the aorta the higher the incidence of gangrene. An exception occurred in the popliteal artery, the sudden occlusion of which resulted in a high incidence of gangrene. Reported series of sudden occlusion by emboli showed the incidence of gangrene to vary between 30 and 70 per cent. In another author's series of 44 emboli occurring in 36 patients of whom only 12 were operated upon, the incidence of ischemic gangrene was 67 per cent. Sudden occlusion of a major peripheral artery resulting from an operation for the cure of an aneurysm carried with it an incidence of ischemic gangrene of 5.2 per cent (Matas) and of 15 per cent (Bird).

The sudden occlusion of a major peripheral artery produces the following pathologicophysiological changes: (1) sudden obliteration of the peripheral pulse, (2) marked decrease in the blood volume flow, (3) rapid fall in the temperature of the limb, (4) temporary or even permanent cessation of the capillary pulsations, (5) marked and sustained decrease in the arterial and venous residual pressure, (6) moderate to severe vasospasm of the entire arterial tree distal to the arterial obliteration, (7) decrease or cessation of the lymph flow, (8) concomitant venospasm, (9) mass of blood in the limb and blood volume flow per minute greatly diminished, (10) interference with the vasa vasorum circulation by arterial vasospasm, and (11) pathological changes within the vessel wall resulting in thromboses. To prevent the ischemic gangrene it is necessary to: (1) test the efficiency of the collateral circulation, (2) develop collateral circulation when found deficient, (3) prevent segmental and diffuse arterial vasospasm, (4) prevent venospasm, (5) increase the blood volume flow through the collaterals and the main vessel distal to the ligature, (6) maintain the capillary pulsations, (7) maintain the lymph flow, (8) increase the peripheral residual pressure, (9) maintain a normal or elevated tissue temperature, (10) increase the blood volume flow through the vasa vasorum, and (11) prevent thrombosis of the peripheral arterioles and capillaries.

The following methods of testing the collateral circulation are advocated: Moszkowicz' test, oscillometric readings, plethysmographic readings and thermocouple readings, and the Matas compressor. Traumatic and embolic lesions of the major peripheral arteries do not allow time for accurate study and testing of the collateral circulation. The methods used to develop a collateral circulation are divided into the following groups: (1) spontaneous; (2) mechanical, including the Matas compressor, intermittent venous occlusion, and ligation of the concomitant veins; and (3) physiological, which include interruption of the sympathetic impulses, which can be accomplished by novocaine or alcohol block of the ganglia or by ganglionectomy. The authors recommend novocaine block as the procedure of choice. The technique of novocaine block of both the lumbar sympathetic and stellate ganglia is described.

The effects upon the peripheral vascular tree following occlusion of the main artery are itemized as follows:

1. Spasm of the main peripheral artery.
2. Spasm of the collaterals.
3. Low arterial pressure distal to the occlusion.
4. Decreased peripheral venous pressure.
5. Increased pressure proximal to occlusion.

6. Decreased blood volume flow per minute.
7. Decreased arteriolar pulsations.
8. Slowing and stasis of the lymph flow.
9. Decreased flow through the vasa vasorum.
10. Decrease in the number of collaterals through which blood flows.
11. Slow development of the collaterals.
12. Degenerative changes in the vessel wall.
13. Occurrence of thrombosis.
14. Muscle necrosis.
15. Gangrene.

The effects of sympathectomy upon the peripheral vascular tree following obstruction of the major peripheral artery are as follows:

1. Vasodilation of the main peripheral vessels.
2. Vasodilation of the collaterals and increase in number.
3. Return to normal of the arterial pressure distal to occlusion.
4. Return to normal of the peripheral venous pressure.
5. Increased pressure proximal to the occlusion.
6. Sustained increased blood volume flow per minute through the main artery and the collaterals.
7. Increased return of the arteriolar pulsations.
8. Increased lymph flow.
9. Increased number and size of the vasa vasorum.
10. Increased number of the collaterals.
11. Rapid development of the collaterals.
12. Increased blood supply to the vessel wall.
13. Thrombosis extremely rare.
14. Increased blood supply to the muscles.
15. Ischemic gangrene prevented.

Sympathetic block was used to increase the collateral circulation as a preliminary procedure to the ligation of major peripheral arteries in 10 cases. In all but 2 of the cases the collateral circulation was found to be inadequate and in these 2 cases the lesion was in such a location as to prohibit testing with the Matas compressor. The indications for ligation in this series were 1 case of mycotic aneurysm of the right common iliac artery, 2 cases of aneurysm of the femoral artery, 3 cases of aneurysm of the popliteal artery, 3 cases of arteriovenous aneurysm, and 1 case of stab wound of the femoral artery. None of these cases, all of which had a sympathetic block prior to the ligation of the vessel, developed any signs or manifestations of ischemic gangrene.

The authors also report good results in 4 cases of sudden occlusion of the major peripheral vessels by embolism which were treated by means of sympathetic block. In 1 of these cases the embolus was removed following the blocking of the sympathetic ganglia.

In conclusion the authors state, "We believe that sympathetic block will not only decrease the incidence of ischemic gangrene but will also lower the immediate mortality." ALFRED B. LONGACRE, M.D.

Leriche, R.: The Resection of the Aorto-Iliac Junction with Double Lumbar Sympathectomy in the Treatment of Arteritic Thrombosis of the Aorta (De la résection du carrefour aortico-iliaque avec double sympathectomie lombaire pour thrombose artéritique de l'aorte). *Presse méd.*, Par., 1940, 48: 601.

Leriche notes that arteritic thrombosis of the terminal segment of the aorta above the inferior mesenteric artery is probably not as infrequent as is supposed, but it is only rarely diagnosed with certainty, and still more rarely operated upon. The author has operated on 5 cases in which the diagnosis was definitely established. In a number of other cases in which lumbar sympathectomy was done, the diagnosis was suggested but not definitely established. In these cases, the patient usually first came under observation for one of the following symptoms: sexual impotence in the male due to the impossibility of erection which in turn was due to the diminished blood supply to the corpora cavernosa; weakness and fatigue of the lower limbs without true intermittent claudication; muscular atrophy of both lower limbs, not of as marked degree as the unilateral atrophy associated with obliteration of the external iliac artery; or pallor of the lower limbs even when the patient was standing erect, this becoming very marked (marble white) if the legs were lifted above the trunk. There were no trophic symptoms at this stage. If an examination for arterial pulsations was made, none were found in the leg or the femoral arteries; pulsations of the aorta were not perceptible except above the umbilicus; these findings could be confirmed with the oscillometer. The arterial pressure was slightly increased in the upper extremities. As the condition advanced, the legs became cyanotic; there was desquamation of the skin and small trophic ulcers that were very painful developed. This was followed by gangrene, usually beginning in the toes. One of the chief factors in this development was the extension of the thrombosis downward and the appearance of peripheral venous thromboses.

In the first case operated upon by the author in which the diagnosis of aorto-iliac thrombosis was made, lumbar sympathectomy was done at the highest possible level, with removal of the first lumbar ganglion on both sides. The patient showed marked improvement after the second operation on the left side, and this improvement has been maintained for three years and a half since the first operation. While sympathectomy with the removal of the first lumbar ganglion on both sides gave good results in this case in which the aorta was found to be obliterated for from 2 to 3 cm. a little above the bifurcation, the author considered that better results would be obtained in such cases by resection of the thrombosed segment of the aorta and iliac arteries, combined with lumbar sympathectomy. This operation has been done successfully in 1 case. The patient was a man sixty-one years of age in whom aortography showed an obliterative thrombosis of the aorta at the level of the third lumbar vertebra. In

this case the terminal segment of the aorta and the thrombosed portions of the iliac arteries were resected and a lumbar sympathectomy was done through a single incision and in one stage. The patient made a good postoperative recovery. The gangrene in one foot subsided, but amputation had to be done on the other side. The author has since lost track of this patient because of war conditions; but the results prove that the combined operation can be done with safety, and that it results in improvement; but it is not always possible to arrest and heal established gangrene. ALICE M. MEYERS.

BLOOD; TRANSFUSION

Theil, P.: The Determination of Blood Groups, the Beth-Vincent Test and Its Errors, and a Simple Method that Gives Absolute Security (La détermination des groupes sanguins, l'épreuve de Beth-Vincent et ses erreurs; comment peut-on opérer facilement en toute sécurité). *Presse méd.*, Par., 1940, 48: 594.

Theil notes that in the present war the character of the wounds involves severe hemorrhage and shock, and consequently blood transfusion is of prime importance to the surgeon; for this reason the question of blood grouping is receiving much attention. The most widely employed method of blood grouping—the Beth-Vincent test—while simple and rapidly performed, is subject to definite errors. These errors may be classified as qualitative and quantitative. The qualitative errors are those due to false or non-specific agglutination, such as agglutination due to cold or microbial contamination, or pseudo-agglutination, which is due to "piling up" of the red cells, one on top of the other, as can be demonstrated by microscopic examination, but which gives the same macroscopic appearance as true agglutination. A control test with AB serum may be made, as pseudo-agglutination is as marked with this serum as with that of Group A, B, or O. Also, dilution or washing of the red cells avoids pseudo-agglutination. Quantitative errors occur when true agglutination is so slight that it is not demonstrated by the test; this may be due to too little agglutinin in the serum, or too little agglutinogen in the red cells.

In the course of studying many blood grouping tests in the laboratory, the author has come to the conclusion that agglutination can be most accurately determined by microscopic examination of blood that has been diluted, citrated, and formolized. This test has been used as a check on the Beth-Vincent test, especially for the O blood group. One or two drops of the blood to be tested are mixed with a solution containing 1 part of sodium citrate and 1 part of 40 per cent formol to 100 parts of physiological saline solution; one drop of normal blood is added to 200 c.cm. of the saline solution, so that the mixture has a slight rose tinge, lighter in color than the 5 per cent mark on the hemoglobinometer of Tallqvist. This suspension of the red cells is kept for a few minutes at room temperature or in the incubator. Then three drops of the suspension are placed on a glass slide, and one drop of an A serum is added to the first drop, one drop of a B serum to the second drop, and one drop of an O serum to the third drop. The serum and red-cell suspension of each test are mixed with a small stylet, and the slide is held in balance for about a minute so as to aid the mixing process. Microscopic examination of each test is then made; this shows the red cells to be clearly separated and no agglutination, or definite agglutination. Several portions of each test mixture are examined carefully in order to reduce the chance of error. This test has been found to avoid the errors of the Beth-Vincent test. The dilution of the blood to be tested is sufficient to avoid pseudo-agglutination, while the microscopic examination of the tests with the method of dilution employed makes it possible to detect the slightest degree of agglutination. After the blood has been citrated and formolized, it can be transported considerable distances before the test is made, and if necessary the rosy tint can be restored by further dilution. ALICE M. MEYERS.

Clemens, J.: Blood Transfusion with the Employment of Vetren and of the Infusor (Die Bluetuebertragung mit Verwendung des Vetrens und des Infusors). *Fortschr. d. Therap.*, 1940, 16: 235.

The author considers the possibilities of limiting the general reactions incident to blood transfusions, when the transfer of tiny blood clots and even of preclotting substances is prevented. The diminution of precoagulative substances should, from a biological standpoint, be a therapeutic requisite. The author has succeeded in complying with such a requisite in collaboration with the manufacturing firm of Promonta, using the new preparation of heparin (vetren), and a transfusion apparatus (infusor). He relates the development of his procedure and of the apparatus, as well as the technique of their application, and comes to the conclusion that the slow transfusion of vetren-blood and the fractionated transfusion of citro-vetren blood, and even of sodium citrate-blood represent a marked advance, which in extensive substantiative application has stood the test.

The advantages of the infusor are the possibility of the immediate transfer of native blood as well as of indirect transfer, and preservation of the blood, all with the same apparatus. Also there is the manifold application with various techniques: rapid, slow, and fractionated transfusion, and the use of the apparatus with physiological solutions. The apparatus is easily manipulated under the most primitive conditions, by the physician without other assistance. The blood from the donor flows into the container, and, during the transfusion, out of it with unsurpassed ease. Troublesome filtering of the blood is avoided. The conservative manner of the transfer of the blood permits of widening the field of therapeutic application blood, a most biologically perfect solution, in its unchanged state, as a substitute for blood which has been lost or which has become unable to function properly, as a stypticum, tonicum,

as an immunity-carrying material, and for nutritional purposes. The apparatus comes to the user in sterile condition and with all the accessories necessary for blood transfusion or for infusion. Thus the patient is assured of immediate treatment, the physician is spared periods of waiting, and preparations may be made at the most favorable opportunity. The apparatus is made of an excellent quality of material whether of prohaemit or glass, and will withstand boiling or sterilization with dry heat at 120 degrees, will maintain its shape, and will withstand bumps and knocks incident to handling.

The low conduction for heat and the simplicity of construction make the apparatus easy to set up and assure its technical reliability. The infusor, particularly that constructed of prohaemit, limits the development of thrombokinase while the vetren combines with the toxic substances. The method allows of fractionating the blood dosage with regard to amount and to time.

The author is of opinion that with this method the technical and therapeutic problems of blood transfusion have been solved.

(Heinemann-Grueder). John W. Brennan, M.D.

Knoll, H., and Maerki, H.: An Experimental Study Concerning Blood Transfusions on the Field of Battle (Experimenteller Beitrag zur Frage der Bluttransfusion im Felde). *Schweiz. med. Wchnschr.*, 1939, 2: 744.

The question of blood transfusion on the field of battle, particularly on the extreme front lines, has become acute during the past few years. For the past three years the authors have devoted themselves to the task of determining the possibility of blood transfusion under the most difficult circumstances similar to those encountered at the front. The Spanish Civil War has shown that this possibility actually exists and has proved very useful. Regarding the present war, reports are still lacking.

Transfusion of fresh blood is, indeed, hardly possible in the extreme front lines. In the first place, there is a dearth of healthy donors, because soldiers and personnel of the military medical corps should not be used for this purpose; the possibility of determining the proper groups is also lacking, as well as trained personnel and the necessary apparatus. The surgical ambulatory clinic may well be regarded as the foremost place where transfusion may be possible. The apparatus should be as simple as it possibly can. For this purpose, an anticoagulating substance is necessary, heparin or citrate. Heparin has been proved adequate for the use of fresh blood. The advantage of this substance is that it can be stored in small sterile ampoules. The authors are in favor of indirect transfusion: in order to carry this out, an intermediary vessel is needed. The Merke flask has proved best for this purpose.

Transfusion with stored blood is undoubtedly better than transfusion with any of the blood substitutes. The action of stored blood is similar to that of fresh blood. According to the experiences of the Mayo Clinic, complications are even more infrequent. The authors recommend a group of central stations, similar to those established during the Spanish Civil War. They reject the proposal of Hencier to erect blood storage depots close behind the front lines: first, because of the dearth of donors; second, because sterility cannot be adequately observed, and third, because the blood could be stored for only one or two days. On the other hand, stored blood which has been bottled at home under every precaution can be used for transfusion from fifteen to twenty days. Duran Jorde and DeBlasio filled the ampoules under pressure. This has two advantages: (1) an infection can be recognized immediately, and (2) the blood can be infused more easily. These workers do not recommend heparin for the stored blood, but rather 5 per cent sodium citricum, in the quantity of 5 c.cm. to 100 c.cm. of blood.

The authors then describe their technique for the bottling of the blood in the ampoules. They do not fill the ampoules under pressure because the chemical results are somewhat poorer when pressure is used. The danger of infection is not great. The blood should be stored at a temperature of +4° C. and should be heated slowly to 37° C. just before using. Lower as well as higher storage temperatures have a tendency to hasten hemolysis. Further, hemolysis is hastened as a result of shaking the blood. This fact is of importance in the transportation. The authors have studied the transporting of blood by railway, by automobile, and by pack saddle on horses. Their method of packing should be read in the original article. It was found that with their method of packing, hemolysis did not occur even when the material was transported by galloping horses. A small rubber pump was added to each ampoule. In order to maintain an even temperature, army cooking boxes containing a refrigerating mixture proved to be adequate.

The arguments against the use of stored blood on the battlefield do not hold water. The only difficult matter is that of organization, but even that is easier than one might usually assume beforehand. The authors then describe the technique for Switzerland.

At the front line of battle, transfusion of stored blood is the only type that comes into question: (1) because this can be carried out by one person in the most simple manner even under the most difficult circumstances, and (2) because determination of the proper blood group is unnecessary. The Spanish Civil War has shown that the blood from the universal donor is adequate.

(Franz). Harry A. Salzmann, M.D.

LYMPH GLANDS AND LYMPHATIC VESSELS

King, E. S. J., and MacCallum, P.: The Development of Lymph Nodes in Fat. *Australian & New Zealand J. Surg.*, 1940, 10: 126.

In surgical practice an apparent increase in the number of lymph nodes is frequently observed in a

region where these drain an organ or tissue affected by inflammation or new growth. Although it is agreed by some that this is an actual new formation of the lymph nodes, others consider that minute lymph nodes already present merely become sufficiently large to be easily apparent. This second view is possibly the more commonly accepted hypothesis.

The examination of a number of specimens removed at operation led the authors to conclude that new lymph nodes are formed, and almost invariably these arise in fatty tissue. Regeneration or new formation of lymphoid tissue is to be expected when one considers the almost universal regenerative capabilities of tissues in the body. The formation of new lymph tissue in fat only is considered herewith.

The evidence for the new development of lymph nodes is of three kinds: (1) clinical study, together with gross operative findings; (2) histological examination of pathological material; and (3) experimental observation.

The clinical observations include the recurrence of lymphatic nodes after their removal; the increase in the number of lymph nodes in regions involved by tuberculosis, Hodgkin's disease and malignant tumors; and the discovery of lymph glands in unusual locations following acute infections, as well as in pregnancy and lactation.

In histological examination, all gradations between lobular fat and a complete lymph gland may be observed in one area. The conclusion that the various conditions observed indicate stages in the development of lymph nodes would not necessarily be justified if made from this alone. In some cases a single nodule, which has developed under observation, is found in a mass of fat with a small amount of peripherally situated lymphoid tissue. Also, if, in areas showing the numerous gradations, it is assumed that fatty change has occurred in the lymph nodes, it necessarily follows that, since some of the masses are entirely fatty, a much greater number of lymph nodes than could reasonably be expected to be present must have been in the region originally.

The experimental work is of two kinds: (1) the determination of regeneration in a damaged lymph node, and (2) the observation of new lymph nodes.

In conclusion, these workers note:

1. Lymph nodes which drain an area in which there is inflammation or new growth are more apparent and more numerous than in normal circumstances.

2. All gradations may be found between fat lobules and lymph nodes.

3. Lymph nodes may be found, in both experimental and clinical conditions, in situations where they are normally absent.

4. The combined evidence, clinical, histological, and experimental, indicates that lymph nodes often arise in fat tissue. HERBERT F. THURSTON, M.D.

THE CHEMICAL PATHOLOGY OF BURNS

Collective Review

CONRAD R. LAM, M.D., F.A.C.S., Detroit, Michigan

THE importance of the treatment of the patient as a whole in the therapy of burns has been emphasized so much by recent authors that it seems trite to mention it again in the opening paragraph of this review. For example, McClure (42) stated, "Disagreements regarding the proper local treatment should not distract our attention from the more important problem—the treatment of a very sick patient who has a threatening toxemia, alterations in the blood chemistry, a wound very susceptible to infection and pathologic changes in organs remote from the skin." In this country, surgeons have assumed the care of burns, although not always enthusiastically. However, it is difficult to think of a clinical entity in which the patient is more in need of the "metamorphosed" surgeon described by Naffziger (48), the surgeon who has a usable knowledge of modern physiology, biochemistry, and other basic sciences.

An extensive review of the entire subject of burns by Harkins (25) appeared in 1938. The present review seeks to assemble the significant contributions of the past five years to the chemical and physicochemical part of the burn problem.

WATER BALANCE

Almost invariably, the first and only request of the burned patient in the emergency room is for "a drink of water." This is evidence of the earliest and simplest of the physicochemical changes, alteration in the fluid/solid ratio, i.e., dehydration. The principal cause of this is the loss of water, along with other plasma components, into the tissues which are becoming edematous at the expense of intravascular water. In addition, some water is lost externally as a special effect of the burn. Theoretically, with flame burns some water might be vaporized as steam at the instant of injury. This is almost certainly negligible, although in Harkins' (26) experiment on the rate of fluid shift, the burned side became lighter for a brief period (Fig. 1). Temporary constriction of the arterioles as a result of the irritating stimulus could have produced this difference in weight.

From the Division of General Surgery of the Henry Ford Hospital, Detroit, Michigan.

The rate of evaporation from burned surfaces was investigated by G. S. McClure (41). An apparatus was devised so that dry air could be passed over an area of skin, and the amount of moisture picked up could be measured. He found that the rate of evaporation from burned surfaces was two and one-half times that of normal skin, but a tannic-acid eschar almost completely inhibited evaporation. If one assumes a normal loss of 1 liter of water per day from the skin, an untreated burn of one-third of the body surface would cause an additional loss of approximately 500 c.cm.

In addition to the special demand of the burn for water, the usual needs, namely, water for urine and insensible loss through the lungs and skin, must be kept in mind. This phase of the problem has been dealt with by Coller and Maddock (12). The higher figure for insensible loss, namely 2,000 c.cm., would apply because of the fever which accompanies the burn. A daily output of urine of at least 1,500 c.cm. should be obtained as soon as possible, and if amounts of from 3,000 to 4,000 c.cm. are obtained during the first five days, it is a favorable prognostic sign. Another source of loss of fluid is vomiting, and amounts lost in this manner should be replaced with normal saline solution administered intravenously.

It must be borne in mind that plain water must be supplied to fill the demands for insensible loss and urine, and not to replace the protein-containing plasma which has left the blood stream and made the blood concentrated, with high hemoglobin and hematocrit values. For this purpose, plasma itself should be used, as will be discussed later. Trusler and his associates (57) have presented impressive case reports and experimental data to show the danger of adding "water intoxication" to the existing injury. They described the case of a two-year-old child who was treated with large quantities of crystalloid fluids. Generalized edema appeared, and the child died in convulsions. The blood chloride level just before death was 140 mgm. per cent! These investigators conducted animal experiments and found that excessive amounts of saline solution given intravenously and of water given by mouth

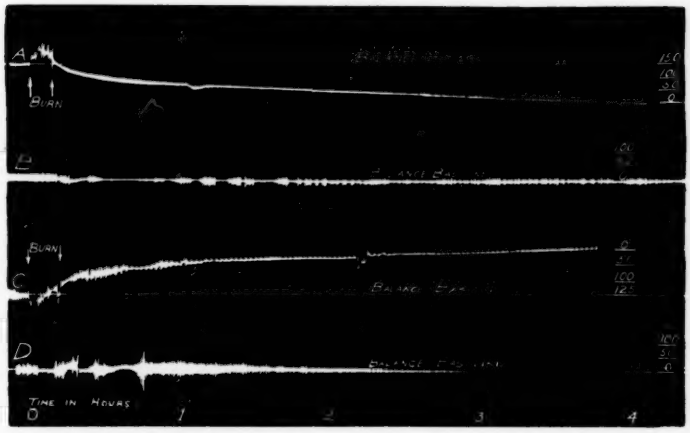

Fig. 1. Kymograph tracings obtained in the experiments of Harkins (26) on the rate of fluid shift in burns: A, burn experiment; B, control experiment; C, burn experiment; and D, control experiment. In A the burned side is away from the drum, so that the shift to the burned side causes the recording point to move downward. In C the burned side is toward the drum and the shift causes the recording point to move upward. The calibration figures on the right represent grams. The animals weighed 6.3 kgm. and 5.2 kgm. respectively, in experiments A and C. (From *Arch. Surg.*, 1935, 31: 71.)

have a deleterious effect. They stated that repeated blood transfusions and the administration of moderate quantities of fluid with dextrose and salt constituted the treatment of choice. Minot and Dodd (46) have also warned against the use of crystalloid solutions when a protein-containing fluid is needed.

Water, *per se*, therefore is necessary only for loss by evaporation and for the secretion of urine, and a daily intake of from 3,500 to 4,000 c.cm. may be sufficient. This may be drunk by mouth, preferably in the form of fruit and vegetable juices with added salt. If there is vomiting, the fluid will have to be given intravenously in the form of a 5 per cent solution of dextrose with normal saline solution. The amount of saline solution which should be given will be discussed under the heading of chlorides.

LOSS OF PLASMA AND PLASMA PROTEINS

It is now well established that the blood concentration of burns and probably many of the shocklike symptoms of burns are due to the leakage of plasma through the capillaries into the tissues at and near the burn, as well as tissues remote from the injury. This results in a loss of blood volume which is considerable. Blalock (8) burned one side of an experimental animal, later bisected the animal, and noted an average difference of 3.34 per cent of body weight. Harkins (26) varied this experiment, placing the animal on a balanced trough, which tipped as one side became heavier, and a recording was made on a drum. He found that half of the shift took place in one hour. The average shift before death in his animals was only 2.2 per cent.

Moon (47) believes that Blalock and Harkins have overestimated the importance of the fluid which accumulates at the site of injury. He stated, "Experiments of this type include a factor of error which was not taken into account. As fluid escapes from the blood into the tissues of the affected side, fluid is simultaneously absorbed from the tissues of the normal side thereby decreasing its weight. Suppose 100 gm. of fluid were so shifted: the difference in weight of the two sides would be 200 gm., but the actual gain of the affected side would be only 100 gm." Moon believes that hemoconcentration is significant in shock and burns, but that most of the fluid loss is general, and occurs in tissues distant from the burn.

In his rebuttal to the criticism of Moon, Harkins (28) points out that the factor of error mentioned by that author would be present only if the entire half of the animal were burned. If only one-sixth of the tissue of the body were burned, the error would not be more than 20 per cent because two-thirds of the treated side is also normal, and would share in the theoretical weight loss of the normal side.

Harkins (27) made observations on the bleeding volume in burns (the amount of blood which will flow out of the carotid artery). Control animals bled 53.4 per cent of the calculated blood volume; animals burned and bled before the blood pressure was greatly lowered bled 31.4 per cent, and animals bled after the blood pressure was below 60, bled only 16.3 per cent of the blood volume.

Keeley, Gibson, and Pijoan (33) studied the changes in plasma, cell, and total blood volume and other chemical changes in a series of 7 dogs. Observations extended over a period of from eight to ten hours after the burn. Plasma and blood volumes were determined by the method of Gibson and Evans. Marked reduction of plasma volume was noted, from 21.5 to 60.7 per cent. Four of these animals had been splenectomized previously. Three of these showed a decrease in the circulating red-cell volume of 7.8 per cent, 13.1 per cent, and 27.8 per cent, respectively. The non-splenectomized animals had an increase in red-cell volume of 59.5 per cent, 24.6 per cent, and 22.3 per cent. The serum-protein concentration remained fairly constant, because in these acute experiments, with no fluid being supplied, there was little or no tendency toward replacement of the lost plasma by dilution of the remaining plasma with other fluid.

In the treated human case, adequate or excessive fluids are given by mouth or parenterally, and a dilution of the plasma proteins occurs in a day or two. Weiner, Rowlette, and Elman (60) reported a series of 40 burns, and low serum-protein values were encountered, as low as 4 gm. in some cases. These writers advised that plasma rather than whole blood be given when there was protein deficiency. Whole blood and plasma transfusions were used by McClure (42, 43), Trusler, Egbert, and Williams (57), McClure and Lam (45), and Elkinton (19) (Fig. 2).

Elkinton, Wolff, and Lee (20) have recently made a significant contribution to burn therapy by devising a formula for use in the quantitative replacement of plasma deficits. The statement of McClure and Lam (45) in April, 1940, that "the indications for blood and plasma transfusions are not well defined at the present time" may no longer be true. The chief assumption in the formula of Elkinton, Wolff, and Lee is that the volume of the circulating red cells remains the same and that changes in the hematocrit reading after burns are due entirely to changes in the volume of the circulating plasma. This assumption is not valid in the light of some of the results of Keeley, Gibson, and Pijoan (33) who found an apparent increase in the volume of circulating red cells of 59.5 per cent in one instance! However, it may be that the volume of circulating red cells in the human being is constant enough for application of the formula; at any rate, the formula seems to work well when applied clinically. The formula is as follows:

$$\text{Plasma protein deficit in grams} = 3.5\ W - \frac{W(100\text{-}Ho)HnPo}{2\ (100\text{-}Hn)Ho}$$

W is the weight of the patient in kilograms, Ho is the observed hematocrit, Hn is the normal hematocrit (44), and Po is the observed plasma-protein concentration in grams per cent. To convert grams of protein into cubic centimeters of plasma, one multiplies by the factor 14.

The application of this formula shows that there is a surprisingly large loss of plasma volume with a moderate increase in the hematocrit reading. For example, an increase of the hematocrit reading from 44 to 57 per cent indicates a loss of 41 per cent of the original plasma volume! In supplying this deficit, one may give 1,500 c.cm. of plasma to a patient with burns of the face and arms; a severe burn of the lower extremities may need from 2,500 to 3,000 c.cm. Elkinton, Wolff, and Lee believed that there is no further loss of plasma after the fortieth hour, the capillaries having regained their impermeability.

The fact that blood banks are becoming more common makes it easier to supply plasma in large amounts. Lehman (36) suggested that the supernatant plasma be pipetted off after the cells had settled out. Strumia, Wagner, and Monaghan (56) have outlined in full the procedure for the use of fresh and preserved plasma. They used plasma in 1,500 transfusions without a reaction; 7,300 c.cm. were given in eleven days to a patient with burns. Hill and his associates (29) used desiccated plasma in the treatment of 6 burn cases. Water was added to the dried material to make a four-fold solution. Fifteen doses averaging 89 c.cm. of the concentrated plasma were given to the 6 cases.

There is great interest in the use of plasma in England as a result of war casualties. Black (7) gave a detailed report of the treatment of 8 burned patients, 7 of whom showed clinical shock. Three infusions of four-fold serum in amounts from 150 to 300 c.cm., and 6 infusions of plasma in amounts from 500 to 2,000 c.cm. were given to 7 patients. One patient with a burn of 50 per cent of the body surface showed no beneficial effect, while "the other eight infusions were all followed by definite, in some cases, dramatic im-

provement." Black submits the following formula as a means of calculating the plasma deficit:

$$\frac{Hb_2}{100} = \frac{5}{(5-x)}$$

Hb_2 is the observed hemoglobin percentage, and x is the plasma deficit in liters.

This formula assumes that the patient had a hemoglobin percentage of 100 before the burn, and a blood volume of 5 liters. Its chief deficiency lies in the fact that it does not take into account changes in the plasma-protein concentration. For example, 1 of this author's patients had severe burns of both legs and died on the fifth day. The hemoglobin percentage on four successive days was 116, 114, 122, and 98, respectively. On the first day, the patient was given 1,600 c.cm. of plasma. Theoretically, on the basis of the author's formula, adequate proteins had been supplied when the hemoglobin fell to 98 per cent. However, on the day of admission, the plasma-protein concentration was only 4.2 gm. per cent, and on the next day, had fallen further to 3.8 gm. per cent, or little more than half the normal concentration, and below the edema level.

Brown and Mollison (10) treated 5 cases of burns with the dried serum prepared at the Medical Research Council drying unit at Cambridge. They found it to be non-toxic, and its use in the treatment of shock was followed by successful results.

In a recent article, Elman (21) reviewed the evidence for the generous use of plasma in burns, and presented further case reports. He pointed out that in 1881, Tappeiner wrote that the concentration of blood in burns occurs not through simple water loss, but by the loss of fluid of which the composition is close to that of blood plasma and he recommended the use of transfusions of serous fluid.

Not infrequently, there is a reversal of the albumin/globulin ratio of the plasma proteins. Normally this ratio is about 3 to 2. A reversal was noted in 3 of 8 cases reported by McClure and Lam (45) and in the case of Lucido (38). This finding may have some relationship to the liver injury which frequently occurs in severe burns, as will be discussed later. Identical changes in the composition of the plasma proteins have been observed in various diseases of the liver parenchyma by gastro-enterologists (59). Another possibility is that the smaller albumin molecules escape from the capillaries more easily.

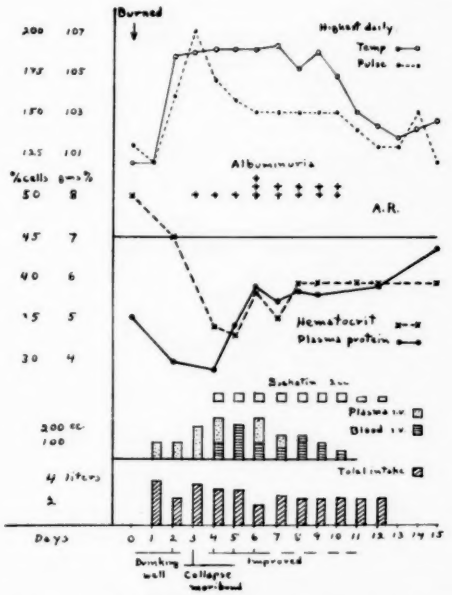

Fig. 2. Clinical chart of twenty-five-month-old child with second and third degree burns of the entire back and most of the chest and abdomen, reported by Elkinton (19). This illustrates the marked plasma protein loss in the presence of hemoconcentration, with satisfactory response to plasma and blood transfusions. (Reproduced with the permission of the Editor of the *Bull. Ayer Clin. Lab., Penn. Hosp.*)

CHLORIDES

There is disagreement regarding the behavior of the blood chlorides in burns. Davidson's (14) early observations that there is a significant lowering of the whole blood and plasma chloride have not been well substantiated. Some of the confusion is undoubtedly due to the fact that most clinical cases are treated with saline solution given parenterally, and the defect may be corrected before it is apparent. Both Davidson and Harkins (28) have emphasized that since the cells contain less chloride than the plasma, in the case of the hemoconcentration of burns, examination of the whole blood would give a lowered chloride value, while the concentration of chloride in the plasma might be the same. However, a blood concentration of 70 per cent hematocrit would reduce the sodium-chloride content of whole blood only from 500 to 489 mgm.

In the acute animal experiments of Keeley, Gibson, and Pijoan (33), the serum chlorides were determined in 6 dogs. Three showed little

change in the serum-chloride concentration, 2 showed elevations of about 50 mgm. per cent, and 1 showed a decrease from 641 to 473 mgm. However, since there was a great decrease in the amount of circulating plasma, the total amount of salt in the circulating blood was reduced proportionally. Perez (49) produced burns in rabbits and noted the change in the chlorides of the plasma and cells after one hour. Scalding caused a decrease of 11.7 per cent in the plasma chlorides and 1.5 per cent in the cell chlorides. Acid burns caused 8.7 per cent and 6.8 per cent decreases for plasma and cells, respectively, and alkali burns, 10 per cent and 6 per cent, respectively. To compute the percentage decrease in whole blood, the author added the figures for plasma and cells, e.g., 16 per cent for alkali burns. This is erroneous, of course. Assuming a hematocrit reading of 50 per cent, the percentage decrease for whole blood would be 8 per cent in this case.

Wilson and Stewart (63) studied the blood chemistry in 41 patients, most of whom were children. In 20 cases showing lowered serum sodium, the blood sodium-chloride averaged 513 mgm. per cent, with a range from 430 to 698 mgm. per cent. The usual change was an increase. Stenger (55) studied 6 burned children and found a decrease in chlorides in all 6 cases. Several French writers reported hypochloremia in burns, and believed it to be important (4, 16, 35). It is thought by some that there is general chloride retention, such as occurs in pneumonia. Some of the chloride is to be found in the edematous areas. The excretion of chloride in the urine is suppressed in the early days following a burn.

From the above studies, it would appear that the chloride loss in burns is not large or significant. Moderate parenteral doses of saline solution (from 500 to 1,000 c.cm. daily) or even the salt in the diet will take care of the chlorides lost into the edema fluid of the burn and in the urine. If there is vomiting, the vomitus should be measured and replaced with saline solution according to the usual surgical principles. If for any reason blood-chemistry determinations show a low chloride level, replacement may be made according to the formula of Coller and Maddock (12). These authors advise that 0.5 gm. of salt per kgm. be given for each 100 mgm. of lowering of the plasma-chloride value below the normal 560 mgm. per cent. It should be emphasized again that large amounts of saline solution should not be given without indication. If excess chloride is given, it must be excreted by the kidneys along with part of the water, and nothing is gained.

Basic Ions

Sodium. Investigators agree generally that there is a decrease in the serum sodium after burns. Perez (49) found the sodium down from 4 to 9 per cent in rabbit experiments. Extensive studies on clinical cases have been made by English investigators. Wilson and Stewart (63) studied 41 cases and found the serum sodium below 300 mgm. in 15 cases, between 300 and 320 mgm. in 18 cases, and above 320 mgm. in only 8 cases (normal—320 mgm.). Lowdon and his coworkers (37) did experiments to trace the sodium. Scalds were produced in cats by immersing the hind limbs and posterior third of the trunk in water at 90 degrees for 5 seconds. After this, the level of the sodium in the serum of the arterial blood and cerebrospinal fluid steadily declined, while the sodium in the red cells tended to increase. These changes were not prevented by section of the spinal cord, decerebration, or removal of the kidneys or of the suprarenal glands. The following facts suggested that sodium was being lost into the scalded tissues: (1) there was no significant fall in the serum sodium if the circulation to the scalded area was occluded before the scalding; (2) the serum of the venous blood from scalded skin contained less sodium than the serum of the arterial blood; and (3) perfusion with heparinized blood of the isolated hindquarters showed a consistent loss of sodium from the plasma of the perfusate. Wilson and Stewart (63) studied the action of the synthetic hormone desoxycorticosterone acetate. They concluded that this substance rapidly restored the normal sodium level of extracellular fluids and corrected other blood abnormalities. It also had an occasional effect in improving circulatory efficiency during secondary shock and the acute toxemia of burns.

Potassium. In their experiments, Keeley, Gibson, and Pijoan (33) found no change in the serum potassium concentration in burns. In Stenger's (55) series of 6 children, there were 4 instances of elevated serum potassium, the highest being 34.2 mgm. per cent. In 20 cases studied by Wilson and Stewart (63), the average value for the serum potassium was 27 mgm., the range being from 23 to 34 mgm. McClure and Lam (45) did not note significant potassium changes (Fig. 3). In his book on "Shock", Scudder (54) records the results of potassium determinations in 6 cases of burns. In 2 instances, there was elevation of the serum potassium to 25 mgm. per cent, but there was no evidence that the hyperpotassemia was related to the degree of shock or the prognosis. This author advised the generous use of adrenal extract (eschatin) and hypertonic sodium-chloride

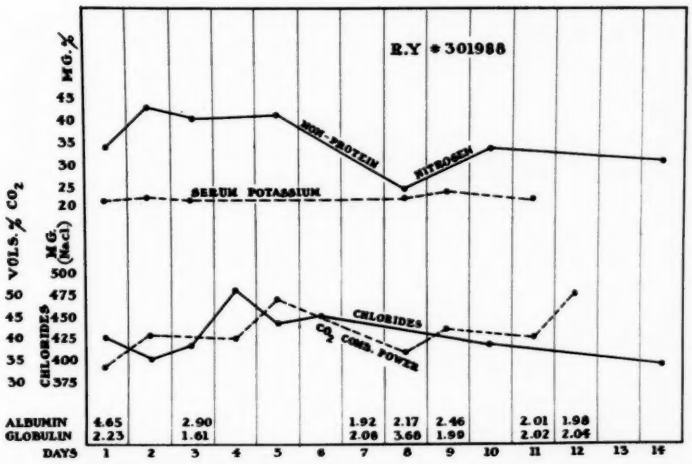
R.Y. # 301988
MG. %
NON-PROTEIN NITROGEN
SERUM POTASSIUM
VOLS. % CO_2
MG. (NaCl)
CHLORIDES
CO_2 COMB. POWER
ALBUMIN 4.65 2.90 1.92 2.17 2.46 2.01 1.98
GLOBULIN 2.23 1.61 2.08 3.60 1.99 2.02 2.04
DAYS 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Fig. 3. Chart showing the blood chemistry findings in a patient with severe burns of the lower extremities. (From McClure and Lam. *South. Surgeon*, 1940, 9: 223.)

solution in burns and other surgical conditions accompanied by shock.

Calcium. In several clinical cases, Wilson, MacGregor, and Stewart (62) found no significant change in the serum calcium. In the rabbit experiments of Perez (49) there was an increase in the calcium from 6.7 to 24.4 per cent.

Magnesium. One investigator (Mattina 40) observed the blood magnesium in 6 rabbits and found it was increased after twenty-four hours, reached its maximum in ten days, and returned to normal in forty days. Magnesium is much like potassium in that it is an intracellular rather than an extracellular electrolyte, and slight increases would be expected to accompany the slight hyperpotassemia.

ACID-BASE BALANCE

The carbon-dioxide combining power of the blood was examined in several of the cases reported by Wilson, MacGregor, and Stewart (62). Values of from 40 to 70 vols. per cent were observed. In a case studied by McClure and Lam (45), a value of 33 vols. per cent, indicating a moderate acidosis was observed (Fig. 3). The writer has seen higher grades of acidosis, with carbon-dioxide combining power values from 20 to 25 vols. per cent in fatal cases, especially in children. No beneficial results were ever observed when sodium bicarbonate was given to some of these patients. Up to this date the writer has not encountered a report of pH studies of the blood in burns.

NON-PROTEIN NITROGEN

Moderate to marked increase in the blood non-protein nitrogen is common in burns. In general, there is an inverse ratio to the urinary output. High terminal values are seen with the complete anuria of some cases. Another factor may be the addition of certain nitrogenous bodies as a result of the destruction and absorption of burned tissues. In their animal experiments, Trusler and his associates (57) obtained values as high as 167 mgm. per cent. In 20 cases, Wilson and Stewart (63) noted an average value of 56 mgm., with a range from 40 to 81 mgm. In several cases, Lambret and Driessens (35) studied the components of the non-protein nitrogen. There was elevation of the blood-urea nitrogen and polypeptide nitrogen which showed a rough parallelism. In 2 instances, there was slight increase in the amino-acid nitrogen.

In clinical practice, the daily determination of the non-protein nitrogen serves as a valuable index to the prognosis.

BLOOD SUGAR

The French writers have described hyperglycemia, which they attribute to excessive adrenalin secretion in the first stages of the burn (35). Wilson and Stewart (63) noted an average blood-sugar level of 105 with a range from 99 to 116 in 20 cases. The blood-sugar values in the experimental animals of Trusler and his associates (57) varied with the type of therapy which the animals received.

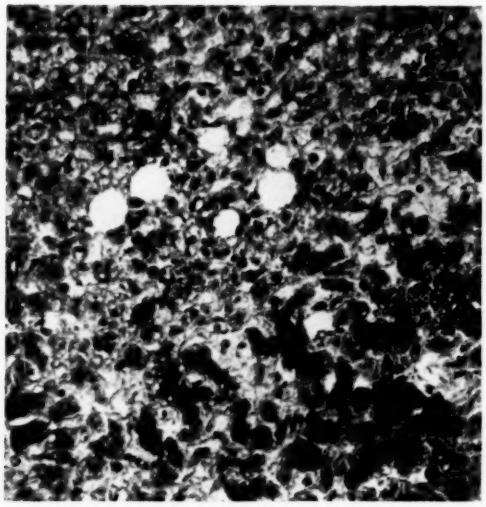

Fig. 4. Photomicrograph of liver tissue removed from patient who died on the third day following a severe burn of 50 per cent of the body surface. All of the liver cells except those in the lower right hand corner show marked degeneration. (From McClure and Lam. *South. Surgeon*, 1940, 9: 223.)

JAUNDICE AND LIVER INSUFFICIENCY

The frequency of jaundice in the course of severe burns has been stressed by Wilson, MacGregor, and Stewart (62), McClure (42), and McClure and Lam (45). The first writers stated, "With increasing experience we have come to regard jaundice as one of the signs of acute toxemia rather than a complication. It was noted in 12 of the cases of the series (65 cases) and would probably have been detected more frequently in the earlier part of the investigation had its import been more fully realized. . . . Jaundice was found during fulminating toxemia even as early as 48 hours after injury, but the more pronounced jaundice occurred in the slowly progressive low grade toxemia of adults, appearing usually about the fourth day. It was certainly not related to any special therapeutic measure, since it appeared under many modifications of treatment and was found in one late admission in which the burns had received no special treatment beyond the application of oil. Nor was it dependent on the sepsis, since in most instances, the presence of sepsis in the burned area was excluded. Jaundice indicated the occurrence of degenerative and necrotic changes in the liver."

McClure (42) told of 2 men who were burned in the same fire. One died on the third day, and at autopsy, the liver showed widespread necrosis (Fig. 4). The other survived, but developed a tender liver and an icterus index of 130 units. The patient in the case reported by McClure and Lam (45) had an icterus index of 80 units on the fourth day and recovered (Fig. 5). Large quantities of glucose were given to aid in the regeneration of the liver. Belt (5) made autopsies on 4 cases of burn and found widespread liver necrosis in all. The histological appearance was similar to the changes found in yellow fever. Buis and Hartman (11) describe the changes in the liver in 5 cases of burns. They suggest that anoxia associated with shock, plasma loss, and hemoconcentration are the principal causes of the liver necrosis.

In addition to the jaundice, tests of liver function show injury to the liver in burns. The case reported by McClure and Lam (45) showed impairment of liver function as judged by the hippuric-acid and galactose tolerance tests, and a low plasma prothrombin was observed. Recently Wolff, Elkinton, and Rhoads (64) made extensive studies on the liver function in 3 cases. They made observations on the bilirubinemia, bromsulfalein retention, hippuric-acid output, plasma prothrombin concentration, and dextrose tolerance. Their results indicated that hepatic damage was present, especially during the period from the third to the tenth day following the burn.

THE TOXIN (?) OF BURNS

The extensive liver necrosis described above has been cited as evidence in favor of the toxic theory of the cause of death in burns. Wilson, MacGregor, and Stewart stated (62), "In summarizing, we may affirm that after death from burns, a lesion of the liver cells was found in many cases which was characteristic of this form of injury. Its relation to acute toxemia was so remarkably close as to leave little doubt that the liver lesion and the acute toxemia were produced by the same mechanism. The responsible agency was certainly not bacterial infection, and, in our view, the liver lesion furnished the strongest indication of a non-bacterial toxin circulating during the first few days after a burn."

It is beyond the scope of this review to analyze the large mass of conflicting data which has accumulated on the problem of the toxin of burns. The status of the problem will be presented by calling attention to some of the more recent work.

There is some debate on the matter of whether or not a burned surface is efficient for absorption. Elkinton (19) cites the work of Underhill and his coworkers, in which it was shown that strychnine

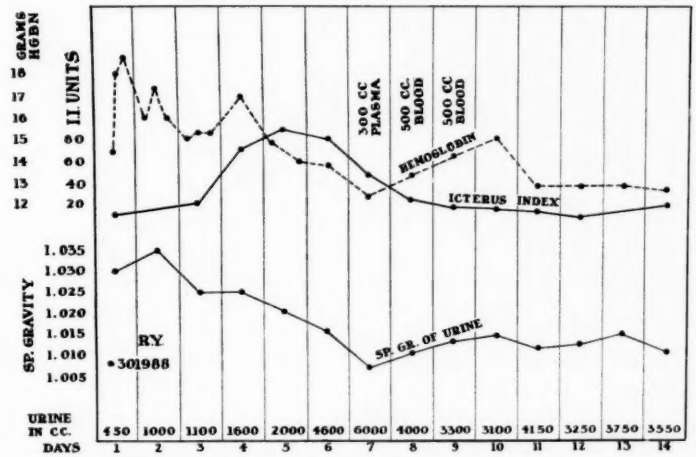

Fig. 5. Chart showing behavior of hemoglobin, icterus index, and urinary output during the first two weeks of burn. (From McClure and Lam. *South. Surgeon*, 1940, 9: 223.)

and dyes were poorly absorbed from burned tissues. Mason, Paxton, and Shoemaker (39) injected potassium iodide into burned tissue and normal tissue, and found that there was no difference in the rate of subsequent excretion in the urine. They concluded that a readily diffusible substance of low molecular weight, such as potassium iodide, is absorbed from burned areas. They also added that death occurring several days following severe burns is due mainly to the absorption of protein decomposition products. Arnaud (1) treated 9 burns with mercurochrome dressings, and nephritis and other symptoms of mercurial poisoning appeared. After twenty-seven hours, mercury was excreted in the urine. In his comment on the report, Graham (23) warned against the use of mercurial antiseptics in such wounds. Hooker and Lam (30) found that sulfanilamide was readily absorbed from burned surfaces. Blood levels of 10 mgm. were easily obtained by sprinkling the powder on small areas of the forearm. Hence, the available evidence indicates that if a harmful substance is formed at the site of the burn, it is apt to be carried in the blood stream to other parts of the body.

Harkins (25) lists 20 substances which have been suggested as the toxin of burns. Protein decomposition products are blamed most frequently. Davidson (13) suspected the toxic rôle of these products and originated the tannic-acid method of treating burns with the idea of changing a large part of the necrotic tissue into insoluble protein tannate. Of course, it is now well established that tannic acid alone will not prevent the typical burn death. Several French writers (17, 18, 35) believe that intoxication with polypeptides is important. Duval, Roux, and Goiffon (18) stated that the average amount of polypeptides in the blood is normally not over 20 mgm. per cent and in the urine not more than 10 mgm. per cent (figures expressed as tyrosine). They stated that in burns, a large amount of tissue is suddenly destroyed and large amounts of polypeptides enter the circulation. Hyperpolypeptidemia was demonstrated as early as six hours after burns and the authors believed that the gravity of the clinical picture was paralleled by the increase in concentration of these split proteins. It was felt that these substances produced multiple visceral lesions. Harkins (38) suspected that the French investigators were overly enthusiastic in this matter, but suggested that the theory should be carefully checked before being put in the discard.

An extensive review of the German literature was given by Guenther (24). He described changes in all the organs, and stated that the injury to the skin is important only because of the amount of toxic products created. In his summary, he stated that the clinical picture which follows burns is that of circulatory collapse of an acute or protracted nature. Its anatomical basis is a hyperemia, slowing of the circulation and stasis in the various organs. There is an accompanying increase in the permeability of the endothelium for constituents of the blood. This leads to exudation of plasma and erythrocytes, which

produces changes in the organs which vary from "serous inflammation" to total necrosis. He compared the heart in burns to the toxic heart in diphtheria and pointed out that cardiac damage results in a vicious circle, since pure cardiac insufficiency may be added to the general circulatory disturbance.

Globus and Bender (22) described a case of disseminated degenerative encephalopathy which occurred in a case of burns. They believed it was on a toxic basis, "auto-intoxication" from broken down proteins. Since "toxic symptoms" did not appear until six weeks after the burns and death did not occur until six months after, it would appear that the case should be regarded as one of chronic sepsis rather than one succumbing to "burn toxin." Brenner (9) reported autopsy findings in a four-year-old child who died following a small burn of the left hand. Unusual inflammatory changes occurred in the heart muscle, liver, and kidneys. There was severe damage to the vessels in all the organs. The author stated that it was the consensus of opinion that these changes are due to the toxic substances from proteins. Harkins (25) criticized this interpretation, stating that since the death occurred on the seventeenth day, it was probably due to infection.

The theory that the toxemia of burns is due to histamine intoxication is an attractive one, and several investigators have searched for histamine in the burned skin and in the blood of burned subjects. Barsoum and Gaddum (2) studied 5 cases of extensive burns, and found the blood histamine to be increased four-fold. This elevation did not parallel the clinical condition of the patients. Kinard and Martin (34) criticized previous reports of histamine assays. They prepared assay solutions from the blood of normal and burned dogs, and noted their effect on the blood pressure of the cat. They concluded that the fall in blood pressure caused by these solutions was not due to histamine, but was possibly due to a split product formed from the blood during the preparation of the assay solution. An albumin-extract solution produced the same type of fall as that which was produced by the assay solution prepared from the dogs' blood.

Rosenthal (51, 52) searched for a histaminelike toxin in the blood of burned pigs, guinea pigs, and human beings, and found a substance which contracted the virgin guinea pig's uterus. This substance was first linked with the red cells, but later with the serum. It differed from histamine in that it was heat labile and did not act upon the guinea pig's uterus under certain conditions in which histamine did. In his second report, this author presented the results of his investigations on the possible formation of antibodies. He concluded that there were indications that the serum of healed pigs and human beings contained substances which neutralized histamine and burn toxin, as indicated by the action of the mixture on the virgin guinea pig's uterus. Normal serum also neutralized histamine and burn toxin to a limited extent, but only at incubator temperatures.

Bernhard-Kreis (6) gave an extensive review of the literature on histamine and its relation to shock, burns, anaphylaxis, and other conditions. He conducted a series of experiments in which extracts of skin and muscle were injected into guinea pigs and rabbits. He could only rarely demonstrate histamine in his extracts. He used two types of extract, one being simply an aqueous extract of tissue, and the other being boiled for two hours. Presumably, the latter was to represent burned or scalded tissue. At the end of the experiments, autopsies showed changes in the livers almost identical with those described in clinical cases of burns (42, 62) (Fig. 4). However, his experiments were continued over a period of four months, injections being made twice weekly. The animals given the plain extract showed more changes in the liver than those given the heated extract. This experiment would appear to furnish little help in the problem of the cause of death in acute burns.

Wilson, Jeffrey, Roxburgh, and Stewart (61) investigated the toxicity of edema fluid from burned tissue. They concluded that this fluid gradually acquires toxic properties and when collected after forty-eight hours, it may be fatal to animals of the same species. Autolysis of injured tissue was believed to be responsible. Toxic effects observed were changes in the nervous system, circulatory depression, and degeneration of the liver cells. The toxic principle seemed to be linked with the globulin fraction.

A Japanese investigator, Ishizawa (32), did experiments with rabbits and was impressed with the possibility that hemoglobin poisoning may be the cause of the early toxic manifestations. He stated that rabbits injected intravenously with hemoglobin solutions prepared from their own or other blood died within a few hours, sometimes with convulsions. He burned rabbits and noted free hemoglobin in the plasma of some of the early blood specimens and hemoglobinuria in some cases. Harkins (25) criticized this work, pointing out that the occurrence of hemoglobinemia appeared to have no relation to prognosis in the experimental animals.

In summarizing the evidence regarding a specific burn toxin, we may say that the matter is still *sub judice*. The experimental methods are such that artifacts are prone to be produced and errors of interpretation are frequent. Competent investigators are unable to reproduce the results of other competent investigators.

If one chooses to be "toxin conscious" in the therapy of burns, there are several rational methods of treatment which suggest themselves. The hepatitis, whether toxic or not, may be treated with large amounts of glucose, given by mouth and parenterally. Adequate diuresis will permit of the possible excretion of toxic products. The exsanguination-transfusion method of treatment was used by one German author (3). If one believes that histamine poisoning is present, the use of histaminase presents itself for consideration.

CHEMISTRY OF BLISTER FLUID

Harkins (28) analyzed blister fluid in 2 cases. In one case, the total protein was 3.4 gm. per cent, the non-protein nitrogen 22.2 mgm., the sugar 58.3 mgm., and the sodium chloride 600.2 mgm. per cent. In another case the total protein was 3 gm., and the sodium chloride 600 mgm. per cent. Thus, the proteins were about half that of plasma, the sugar about half, and the chloride and non-protein nitrogen were about the same as the plasma.

Hughes (31) performed an interesting experiment to determine the immunological properties of blister fluid. Four groups of 10 mice received 0.1 minimal lethal dose of streptococci mixed with 4 types of fluid. When the organisms were injected with normal human serum, 8 mice remained well, 1 mouse became sick, and 1 died. When injected with pleural exudate, 5 mice died, 3 became sick, and 2 remained well. With hydrocele fluid, 1 mouse became sick and 9 mice remained well. When the streptococci were injected with blister fluid from a burn, 9 mice died and 1 mouse showed morbidity.

URINE CHANGES IN BURNS

The chemistry of the urine has not received the attention in burns that has been given the blood. The high specific gravity associated with the oliguria is well known (Fig 5). Albuminuria is almost the rule. Ketonuria, hemoglobinuria, and bilirubinuria are merely evidence of excess of those substances in the blood stream. The French writers describe hypochloruria (4, 16). Duval (16) noted a large urinary excretion of sodium bicarbonate (28 gm.) on the third day of a burn. He believed that this was due to the union of sodium with carbonic acid and the subsequent elimination as sodium bicarbonate, and thought that this explained the empiric fact that the administration of sodium bicarbonate in burns appears to be harmful. In Keeley, Gibson, and Pijoan's (33) experiments, the urine in one animal was studied for amount, specific gravity, and chloride content. The specific gravity reached a height of 1.090, and the last three specimens showed no chloride at all. The behavior of the specific gravity with regard to the urine excreted may be seen in the chart from McClure and Lam (45) (Fig. 5).

Rabboni and Abbruzzo (50) studied the "Donaggio reaction" in the urine of burned patients. This reaction is said to be positive when the substance being tested inhibits the precipitation of thionin in the presence of a mordant, such as ammonium molybdate. The writers found the reaction to be positive in burns, and the intensity of the reaction paralleled the clinical course in the experimental animals. However, since the reaction is said to be positive in all febrile conditions, epilepsy, hemiplegia, herpes zoster, and cancer, it would appear to be too non-specific to be of practical value in the care of burns.

Lucido (38) noted a high urinary nitrogen excretion in a burn case, the values being 30 gm. on the third day, 13 gm. on the eleventh day, and 10 gm. at a later date.

ANOXIA

Keeley, Gibson, and Pijoan (33) studied the oxygen saturation of arterial blood in 7 burned animals. Remarkably low values were obtained, although it should be noted that these animals were under heavy sodium-pentobarbital sedation. The amount of anoxia produced by the barbiturates alone has been observed by McClure, Hartman, Schnedorf, and Schelling (44). Further studies on the oxygen saturation in human burn cases should be carried out. Buis and Hartman (11) believe that the changes in the liver in burns may be largely anoxic in nature. Oxygen therapy has been used in the treatment of burns (57), but the indications are not well defined. The nature of the injury makes the administration of oxygen by the use of a tent technically difficult. There are two reports from England which state that beneficial results have been obtained in the treatment of "burn shock" with the B.L.B. oxygen mask (7, 58).

MISCELLANEOUS OBSERVATIONS

A low blood cholesterol was noted in Lucido's case (38). In animal experiments, de Vincentiis

(15) found a slight increase in the cholesterol. The blood diastase was normal in Lucido's case. Determinations of the blood Vitamin C will frequently show low values, and the implications for treatment are obvious.

COMMENT

It is difficult to summarize and evaluate the data presented in the above review. There seems to be no doubt that the contributions on the subject of hemoconcentration and its treatment by the replacement of plasma are important. Fluid administration has been put on a more rational basis. Replacement must be qualitative as well as quantitative. The problem of the toxin of burns remains unsolved. Recognition of liver damage explains some of the morbidity and mortality in burns. Whether this hepatic injury is due to a toxic substance or to the lack of something, for example, oxygen, is not known. Careful investigative work on this and other problems in burns is needed.

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SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Schultz, W.: The Value of the Blood Picture in Surgery (Der Nutzen des Blutbildes in der Chirurgie). *Deutsche med. Wchnschr.*, 1940, 2: 881.

The author demonstrates the value of the blood picture in surgery particularly on the basis of a severe septic case involving a female patient, who had become ill with an inflammation of the throat fourteen days before admission. During the last week, renewed attacks of high fever with chills made their appearance, so that a sepsis of tonsillar origin was assumed, a diagnosis which was supported by the finding of the streptococcus hemolyticus. The tonsils had already undergone healing, but a descending sepsis originating in the tonsils was assumed, and for this reason it was proposed to undertake either unilateral or bilateral exposure of the jugular vein. However, before the proposed operation, another blood smear was taken, which showed a leucopenia of 3,400 with only 2 per cent neutrophilic leucocytes, 1 per cent eosinophils, and 97 per cent lymphocytes.

Since we know that an increase of the neutrophilic leucocytes of the blood, which is usually accompanied by a shift to the left of the neutrophils, is to be regarded as a defense reaction of the body, while, on the other hand, the existence of a severe neutrophilic defect represents a dangerous loss of resistance in the body against the invasion of bacterial infections, the nature of the situation was therefore clarified and the planned surgical procedure was omitted. In the face of this type of agranulocytosis, surgical procedures are contraindicated. In the instance described, it was not possible to clinically diagnose this agranulocytosis immediately. Inflammations of the oral cavity and tonsils are, among others, suspicious indications. The lack of resistance to surgical procedures of persons suffering with agranulocytosis is very impressive, and cases are known in which comparatively harmless operations have led to a recurrence of an agranulocytosis which had been withstood for a long time, and death followed.

There are, therefore, people in whom the unfavorable reaction of the bone marrow can be discerned beforehand through the existence of a leucopenia and relative lymphocytosis. This is true especially in individuals who have been exposed for a long time to occupational pathological injuries, such as lacquer workers, polishers, and people in the automobile business. As a result of the chronic absorption of benzol, toluol, and similar substances, the bone marrow undergoes injurious changes. Also, some people may undergo changes in the bone marrow, under certain circumstances, in the nature of an agranulocytosis, as a result of the influence of certain medicaments. Among the latter are salvarsan, and bismuth and gold preparations; especially to be noted, however, are pyramidon and substances which contain pyramidon, allonal, or veramon. The sulfanilamide preparations also belong to this group (prontosil, septacaine, albicid, and eubasin); these are preparations which are most likely to be used in septic conditions. Fatal issues have been observed after the use of as little as 30 or 40 gm. of sulfanilamide and prontosil. For this reason one should give the larger doses only for a short time in cases of sepsis, and check up on the blood level at definite periods after doses of 20 gm. have been given.

The treatment of an established agranulocytosis consists of immediate cessation of those medicaments which may be suspected of causing the bone-marrow injury. The effectiveness of medicaments which produce a leucocytosis in the normal individual is questionable; on the other hand, successful results from the use of blood transfusions have been observed. In those conditions in which the situation is questionable, a glimpse into the microscope will reveal the existence of a satisfactory sufficiency of neutrophilic leucocytes. In the same manner, one may obtain information concerning the condition and number of the blood platelets. Their presence in the circulating blood is necessary to the maintenance of the normal capillary blood coagulation time. If there is a dearth of blood platelets, the question of a hemorrhagic diathesis, a condition known as Werlhof's disease, will arise. Even normal individuals can, under certain circumstances, be forced into this condition by certain medication, viz., by taking sedormid. Quinine, ergotine, and phenacetine, are thought to work in a similar manner. The pathological increase in the number of platelets is an important factor in the development of thrombosis and also in the development of postoperative thrombosis. (Bode). HARRY A. SALZMANN, M.D.

Shay, H., Gershon-Cohen, J., Fels, S. S., and Munro, F. L.: The Fate of Ingested Glucose Solutions of Various Concentrations at Different Levels of the Small Intestine. *Am. J. Digest. Dis.*, 1940, 7: 456.

The experimental technique employed by the authors was essentially the same as that previously reported in studies on the absorption and dilution of glucose solutions in the human stomach and duodenum. Glucose meals of 5.4 per cent, 13.5 per cent, and 25 per cent concentrations were instilled into the stomach through a single-lumen tube. With a special four-lumen tube at different levels in the small intestine the behavior of such meals was studied in their course. Highly concentrated glucose meals were found to be undesirable because of irritation to the duodenal mucosa.

The rate of gastric emptying decreased as concentration of the meal above isotonicity increased

because of the effect of hypertonic glucose solutions on the duodenum. In the duodenum low concentrations of glucose were readily absorbed while high concentrations were diluted. The dilution mechanism assures a stream of glucose to the upper jejunum that is at, or below, isotonicity, and under such conditions the small intestine beyond the duodenum acts only in an absorptive capacity. The greatest portion of the glucose of isotonic meals is absorbed by the duodenum and upper jejunum. After hypertonic glucose meals the percentage of total glucose absorbed beyond the duodenum is unrelated to the concentration of the meal or to the total amount of glucose absorbed. The osmotic pressure of fasting intestinal contents was below isotonicity at all the levels studied. Water absorption appeared to be greatest from the lower small intestine.

Blood-sugar curves resulting from the absorption of the glucose at various levels of the small intestine are discussed. WALTER H. NADLER, M.D.

Gius, J. A.: Paravertebral Procaine Block in the Treatment of Postoperative Atelectasis. *Surgery*, 1940, 8: 832.

Previous authors have established the fact that atelectasis is the predominant postoperative pulmonary complication. Hypoventilation of the lungs and decreased efficiency of the cough mechanism appear to be the result of pain in the abdominal incision, which directly and reflexly interferes with abdominal and diaphragmatic excursion. Capelle has shown that continuous anesthesia of the abdominal wound will result in reactivation of the diaphragm and rise of the vital capacity from the usual 20 to 40 per cent of normal immediately after upper abdominal operation to 90 per cent. Morphine will produce an elevation of only 3 to 5 per cent.

The ability to cough effectively following an abdominal operation may be adversely influenced by a decreased amount of tidal air available for sweeping out the pulmonary tree, as well as by pain in the abdominal wound. Forceful movements of the abdominal muscles cause pain, and this results in weak restrained coughs which do not serve to remove secretions. When these secretions are retained, obstruction to the tracheobronchial tree occurs, entrapped air is rapidly absorbed, and atelectasis results. Unless the collapsed areas are reëxpanded, inflammatory changes follow and pneumonia is produced.

The usual methods for evacuating secretions are: active hyperventilation, either voluntary or by means of carbon dioxide inhalations, frequent changes in position and postural drainage, vigorous percussion over the collapsed lobe, expectorants to thin the retained secretions (ammonium chloride or potassium iodide), and intratracheal suction or bronchoscopy.

The author reports 3 cases of postoperative atelectasis following appendectomy in which paravertebral procaine block anesthesia of the wound was induced. Ventilation was augmented and cough became more effective immediately following this procedure. Rapid disappearance of the signs and symptoms of collapse of the lung followed.

The findings suggest that paravertebral procaine block may be of value in the treatment of postoperative atelectasis.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Farmer, C. J.: Vitamin C Analysis in Relation to Clinical Problems. *Quart. Bull. Northwestern Univ. Med. School*, 1940, 14: 220.

This is a detailed review by an authority in the field of Vitamin C metabolism. Vitamin C tolerance tests depend upon the probability that as the tissues become saturated a larger amount of the test dose will be excreted in the urine. The blood level also varies with the diet; in normal young adults the values range from 0.6 to 2 mgm. of reduced ascorbic acid per 100 c.cm. of plasma. If the dietary intake is less than 15 mgm. per day the blood level will be less than 0.2 mgm. per cent; if over 100 mgm. per day, the blood level will be over 1 mgm. per cent. In infants, scurvy may occur with a blood level as high as 0.4 mgm. per cent, but in older individuals the fasting plasma level normally averaged only 0.5 mgm. per cent if the diet had contained an ordinary amount of fruit and vegetables. In adults scurvy usually does not occur until the blood level is much lower than that frequently found at the onset of scurvy in young children. Adult plasma values of about 0.1 mgm. per cent are not infrequently observed in individuals without marked symptoms of scurvy. Little or no correlation existed between the blood level and capillary fragility. Factors involved in vitamin balance, such as completeness of absorption from the intestines, and excretion in the urine and feces, must be considered.

The amount of Vitamin C normally occurring in the feces is extremely small, as shown by studies on patients with esophageal stricture. Bacterial destruction of the vitamin in intestinal loops was studied. The amount absorbed from the intestine increases with the amount administered. Phosphorylation is not necessary for the absorption from the intestine. Apparently the absorption can be explained on the basis of a simple diffusion mechanism. There are approximately 5 mgm. per day in the stool of a normal individual taking adequate amounts of Vitamin C. Even with enormous dosage by mouth the fecal excretion increased to only 10 mgm. per day. The urinary excretion does not increase in direct proportion to increased ingestion. High plasma levels of Vitamin C are thought to maintain at an optimum the rate of production of intercellular substances associated with collagen formation, normal dentine, and bone formation, and the production of non-epithelial cement substances, including that of the vascular endothelium. Clinical and laboratory studies suggest that Vitamin C is important in wound healing. Fecal excretion during

diarrhea in infants is greatly increased. Vitamin C is said to be decreased in the blood of patients with arthritis. Studies on patients with induced hyperpyrexia show no significant difference between the level during the fever and the pre-treatment level.

In relation to detoxifying action, a definite relation of Vitamin C to heavy metals was studied. Iron causes a marked decrease in plasma ascorbic acid, associated with a rapid rise of hemoglobin. Arsenicals also lower plasma ascorbic acid and, as evidence of detoxification, patients previously sensitive to arsenicals have been permitted to resume treatment upon the administration of suitable doses of ascorbic acid, when the optimal plasma value was attained. A high intake of Vitamin C is indicated during heavy metal administration. PAUL STARR, M.D.

Hadfield, G., Swain, R. H. A., Ross, J. M., Drury-White, J. M., and Jordan, A.: Blast from High Explosive. Preliminary Report on 10 Fatal Cases. With a Note on the Identification and Estimation of Carboxyhemoglobin in Formol-Fixed Material. *Lancet*, 1940, 239: 478.

It is established beyond reasonable doubt that sudden death without gross trauma may result from the impact against the body of the violent, rapidly moving wave of high atmospheric pressure produced in the immediate neighborhood of an explosion. The authors carried out detailed post-mortem examination on 10 civilians who had died suddenly or a few hours after short-range exposure to the detonation of high-explosive during aerial bombardment. In all cases circumstantial evidence pointed to death being due to "blast."

In the cases studied, necropsy findings showed that 5 of the individuals died from the effect of "blast" alone. In 3 of the cases the authors brought to light the interesting fact that in addition to lesions produced by "blast," there was such a high degree of saturation of the blood by carbon monoxide as to leave little doubt that carbon-monoxide poisoning was the cause of death, this carbon-monoxide resulting from the combustion of explosives. The remaining 2 patients were found to have died from compression asphyxia rather than from the blast.

The chief and most uniform gross pathological findings in those cases in which death was due to "blast" were (1) the presence of frothy, blood stained fluid in the mouth, nose, trachea, and bronchi, (2) patchy areas of hemorrhage in both lungs, and (3) the absence of subpleural hemorrhages or hemorrhagic rib markings. No other gross pathological findings were noted consistently. Microscopically, the only significant and uniform findings were observed in the lungs. The lungs showed areas of capillary hemorrhages varying in size, and also acute overdistention of respiratory bronchioles, atria, and alveoli. Microscopic bullæ caused by the splitting of the visceral pleura because of the acute emphysema was noted in some cases.

With regard to those cases which terminated fatally because of carbon-monoxide poisoning, the most striking single difference from the "blast" cases consisted of the striking fresh pink color of the hypostasis. Spectroscopic examinations were not always immediately feasible in these cases, but it was found that blood expressed from the lung after formol-saline fixation gave satisfactory spectroscopic determinations both qualitatively and quantitatively. This point was determined experimentally.

In the 2 deaths resulting from compression asphyxiation from fallen débris, the striking features were the capillary and venous congestion and the edema which were found.

Since the amount of blood extravasated into the lung varied greatly and did not produce massive hemorrhages, the authors do not believe that this hemorrhage is the cause of death in "blast" cases. Rather, this lesion is only a trustworthy indication that an individual has been subjected to high pressure. The authors state, "It seems more likely that blast produces death by interfering with some vital tissue or centre in which, from the extreme rapidity of action, structural changes are unlikely to be found." LUTHER H. WOLFF, M.D.

Monod, R.: Some Revisions of the Method of Treatment of Penetrating Wounds of the Chest (Quelques retouches aux directives admises du traitement des plaies pénétrantes de poitrine). *Presse méd.*, Par., 1940, 48: 737.

Some war wounds of the thorax are so severe that the patient dies at once or while being carried to the dressing station, while others are hardly as serious as wounds of the limbs. However, it is the wounds of moderate severity, those between these two types, that have led to so much dispute as to the methods of treatment.

In the last war the general policy was one of abstention from active surgical treatment because it was held that hemorrhage, no matter how threatening, tends to stop spontaneously, both from pressure by the blood and collapse of the lung from the pneumothorax. There was thought to be also less danger from infection than in wounds of the abdomen or limbs because the lung tissue has a certain capacity for killing bacteria. However, toward the latter part of the war a more active treatment was advocated, particularly by Pierre Duval.

The author believes that experience in this war has shown the value of this more active treatment. This method of procedure is justified by the fact that thoracotomy is not a serious operation; it is as simple as an exploratory laparotomy. There are some hemorrhages that do not stop spontaneously and which kill the patient if bleeding is not stopped in time. There are projectiles, particularly fragments of shattered bombs, which are not well tolerated and which cause infection if not removed. Thoracotomy is the only method of stopping hemorrhage, removing projectiles, and preventing infection.

Of course, not all patients are operated on even by the most ardent advocates of surgical intervention.

It is extremely important to be able to make a wise selection of the patients to be operated on. The decision will be based on the nature of the projectile, the roentgen findings, and the presence or absence of fractures. However, operation is performed more frequently than it formerly was because the patient with a wound of the thorax cannot be transported without danger. Therefore, unless it is contraindicated, the patient should be operated on and not transported for at least two weeks. At the end of that time he should be taken back to a base hospital where there are specialists in surgery of the thorax, and which is not too far from the front. A patient with a wound of the thorax should never be dismissed from treatment until he is completely cured. Too early dismissal is the cause of many of the cases of chronic empyema and stubborn fistulas of the pleura which are so hard to cure, and that is why it is so important to place these patients in the hands of a specialist rather than to send them to a general hospital.

AUDREY G. MORGAN, M.D.

Eloesser, L.: The Treatment of Compound Fractures in War; Reports of Practical Experience in the Spanish Civil War. *J. Am. M. Ass.*, 1940, 115: 1848.

The author reports on his experience in the treatment of compound fractures in the Spanish Civil War. Many practical points are discussed with a view to simplification and the elimination of large apparatus or supplies which are difficult or impossible to obtain in a mobile surgical unit.

Preparation of the skin is accomplished with chlorinated lime, and this may be followed by an alcoholic antiseptic solution. The skin is shaved—including all the area to be covered by plaster.

Anesthesia by local infiltration, block or analgesia, is recommended since neither anesthetists nor aftercare may be available. For five-minute anesthetics, ethyl chloride is recommended for inhalation. One hundred mgm. of procaine in 3 c.cm. of cerebrospinal fluid are recommended for fractures of the lower extremity. Evipal is to be avoided in head injuries.

X-ray treatment for the first care of these injuries is believed to be unnecessary and time-consuming.

The position on the table is thought out with a view to assisting in the care of the wound and later application of the cast.

The wounds are thoroughly débrided and all gross foreign bodies removed; an attempt is made to save the deeper tissues rather than the skin. Wounds should not be wiped; devitalized and contaminated muscle should be excised; nerve ends are freshened and brought together with a single fine black silk suture. Tendons should be left if they can be cleaned and covered with soft tissue without tension. A single suture may be used to unite them if it seems likely that they can be covered. If it is not possible to cover them, the ends are left to retract into their sheaths to prevent sloughing; joints are treated similarly. Bones may be wired if necessary, but plates are used only if the wound is left widely open; covering the bone with soft parts without tension may prevent sequestration. Sulfanilamide is used in the wound. Wounds should be closed only about the hand or ankle when no tension is present, and in practically no other case. The wound is packed and a plaster splint is applied.

THOMAS C. DOUGLASS, M.D.

Butler, E. C. B.: The Treatment, Complications, and Late Results of Acute Hematogenous Osteomyelitis. *Brit. J. Surg.*, 1940, 28: 261.

The author has studied 500 cases of acute hematogenous osteomyelitis, 88 per cent of which occurred in patients nineteen years of age or younger. The mortality followed the curve of incidence except in the cases of infants, in which it was much higher. Eighty-eight per cent of the cases of osteomyelitis and 92 per cent of the deaths were caused by staphylococci. The incidence of a primary focus in 49 cases carefully studied from this standpoint was 22, or nearly 50 per cent. The prognostic value of quantitative blood cultures is emphasized. Ninety-seven per cent of 92 cases showed pyemia at post-mortem examination. The mortality was about the same, whether drainage of a periosteal abscess, incision of periosteum with drilling of the bone, or drainage of the medullary cavity was done. Secondary operations were accompanied by a lower mortality.

The complications were chiefly a suppurative arthritis. Others were pathological dislocation, pathological fracture, and peripheral nerve injuries. Fifty-nine per cent of the patients were traced in the follow-up and 87 per cent were found to be at work. The best results in the cases of arthritis followed aspiration.

The treatment is divided into attacks on the toxemia, the bacteriemia, and the local lesion. The first is treated by intravenous injection of antistaphylococcal serum. The author has been discouraged by the use of chemotherapy in combating the bacteriemia and cites 2 cases in which the primary focus was excised with good results, but this hardly seems to be sufficient evidence to encourage one to adopt this method.

Immobilization and relief of tension are the basis for treatment of the local lesion.

THOMAS C. DOUGLASS, M.D.

Haberer, H.: Vascular Surgery under War Conditions (Ueber Gefaesschirurgie im Kriege). *Muenchen. med. Wchnschr.*, 1940, 2: 849.

Definitive hemostasis is always the chief end in view in caring for the severe cases of vascular injury, and only under special circumstances should this be preceded by a temporary control of the bleeding by means of pressure-dressings or tourniquet. Of particular danger are the severing, grazing, and perforating gunshot wounds of the principal arteries because of the deceptive, often life-threatening, secondary bleeding. This may occur even when there is early cessation of the hemorrhage, when one might

be tempted to regard the injury lightly. Noteworthy is the pulsating hematoma which is the precursor of a false aneurysm. The aneurysm itself should not be operated upon before the twelfth day; in the third or fourth week the best results will be obtained. Where feasible, therefore, the development of such an aneurysm should be favored.

For the medical officer accompanying the foremost units the following proposals may be advanced:

Amputation should be done in those instances in which there is no prospect of preservation or functional restoration of the extremity. Ligation in the wound itself or at the location of choice should be done in those cases in which the prospects are more favorable. Pressure-dressings or tourniquets are to be used when the hemorrhage is not dangerous and the conditions of transport are favorable. Finally, the wound should not be disturbed when an initial hemorrhage has ceased.

In the patients with traumatic or false aneurysm, with arterial aneurysm, and with the various forms of arteriovenous aneurysm the diagnosis is easy, as a rule. The important thing, after consideration of the direction taken by the missile and the location of the vessels, is to keep these factors in mind.

The treatment by ligation justified today, at most, is the form in which the aneurysmal sac is slit open and the vessel lumen inside of the sac is closed by ligature. The ideal method is circular or lateral vascular suture. In this last method the suture line is placed in the direction of the axis of the artery, because of the danger of stenosis. In the suturing of the vessel, the aneurysmal sac need not be extirpated, because when it is removed from the effects of the circulation it undergoes obliteration. Accompanying injuries to the veins are ligated with impunity. It is understood, of course, that vascular suture is to be reserved for arteries, ligation of which would be accompanied by danger. To this group belong the common and internal carotid arteries, the subclavian, axillary, cubital, and iliac arteries, and the femoral artery above its junction with the profunda.

The author observed in the World War 251 cases of aneurysm which were operated upon. The operations included 182 vascular sutures, with 237 recoveries. (Druegg). JOHN W. BRENNAN, M.D.

Hall, W. W.: Tetanus Toxoid Immunization in the United States Navy. *Ann. Int. Med.*, 1940, 14: 565.

The work on tetanus immunization in the United States Navy since 1934, some of which has been previously reported, is summarized. It is concluded that active immunization by means of plain or alum-precipitated toxoid is safe and reliable. With properly prepared toxoid, reactions are minor and infrequent. It is pointed out that toxoid immunization has been adopted by the British, French, and Italian Armies. No case of tetanus in individuals immunized with toxoid has yet been reported. The present plan in the Navy calls for 2 injections eight weeks apart as basic immunization; injection at the time of injury if deemed necessary; injection at four-year intervals to maintain immunity at a high level. All midshipmen at the Naval Academy are now continuously immunized with alum-precipitated tetanus toxoid. More than 3,400 have been so protected, as well as many other Navy personnel and dependents. Toxoid immunization is ideal for military services and all other groups which can be medically well controlled. WALTER H. NADLER, M.D.

Maclean, I. H., and Holt, L. B.: Combined Immunization with Tetanus Toxoid and T.A.B. Response to Tetanus Toxoid and to T.A.B. Vaccine—Reactions Following T.A.B.T. *Lancet*, 1940, 239: 581.

The authors have confirmed Ramon's contention that when tetanus toxoid is administered in combination with typhoid-paratyphoid (T.A.B.) vaccine the antitoxic response is much greater than when the toxoid is given alone. Their figures show that it is five times as great, and that after two doses of the combined antigens (T.A.B.T.) given four weeks apart, every subject tested had over 1 unit per cubic centimeter of tetanus antitoxin in his serum. They show, also, that with injections separated by an interval of four weeks the immunity response to the antigens of T.A.B. vaccine are as good as with the usual interval of from seven to ten days.

The procedure of combined immunization will vary according to the circumstances. If there is imminent danger of enteric fever, then the first inoculation should be of the combined vaccine (T.A.B.T.), but in order to obtain immunity rapidly to the enteric fevers a second dose of T.A.B. should be given after from seven to ten days. The second dose could be of T.A.B.T. since the reaction is not greater than with T.A.B. alone. It would be necessary to give a third dose of tetanus toxoid one month later to ensure sufficient protection against tetanus. If there were no imminent danger of typhoid or paratyphoid, then the method of choice would be 2 inoculations of T.A.B.T. with an interval of a month. This would mean that six weeks after the first dose the individual would have a good immunity to both diseases, and would need only 2 inoculations. When the tetanus toxoid is combined with T.A.B. vaccine, an interval of not more than four weeks is necessary to get full immunity.

More than 500 persons were receiving T.A.B.T. and the reactions were no greater than those from T.A.B. vaccine alone. JOHN S. LOCKWOOD, M.D.

Langemeyer, C., and Gottesbueren, H.: The Treatment of Tetanus and the Prevention of Complications from the Use of Serum both in Prophylaxis and in Active Therapy (Die Behandlung des Wundstarrkrampfes und die Vermeidung der Gefahren der Serumanwendung bei der Prophylaxe und der Therapie). *Chirurg*, 1940, 12: 422.

Serum treatment becomes less dangerous with the use of purified protein-poor, 2,000-fold concentrated

horse serum with a protein content of 5 per cent or of the 1,000-fold concentrated cattle serum. A complete separation between antitoxin and serum protein has as yet not been obtained, but the highly concentrated purified sera contain only pseudoglobulin. The phenol content of the sera is harmless. Serum sickness on the whole is overestimated. The fear of serum reactions has led many physicians to do away completely with the employment of sera for prophylaxis. Boehler and others believed that they were able to reach the desired goal by débridement alone. The latter, however, is often practically impossible. The statistics of C. Franz, which showed that since the introduction of passive immunization in the World War, the number of tetanus cases has diminished from 0.38 to 0.04 per cent, speak for the blessings of prophylaxis. Serum shock is almost always preventable. It is necessary to determine, by eliciting a history, whether and when a serum injection had been given previously, and further, whether the particular patient or his family suffer with any form of allergy (horse asthma, a tendency to urticaria, angioneurotic edema, or asthma). Allergy may also be acquired, but we know that this type is usually of a temporary nature. As far as tetanus serum is concerned, we know that ten or twelve days must elapse before sensitization to a foreign protein sets in. In this latent period the authors have repeatedly given large doses of serum intravenously for a week without encountering any form of serum sickness. After this period, hypersensitivity begins to assert itself, but usually, however, this tends to diminish after three or four weeks. Up until the sixth month immediate reactions may still occur, but later the reactions if present tend to be more delayed. After the course of years the hypersensitivity almost always disappears completely.

Serum shock during the period of hypersensitivity occurred only during the course of intravenous injections. The rarity of this condition during the course of the first injection for prophylaxis can be realized by the fact that Bruce saw it occur only 2 times in the course of 2,000,000 injections. On the other hand, he found 12 fatal cases which occurred during the course of administration of only 498 therapeutic doses; however, during war time it is frequently impossible to obtain a proper history. Konjetzny, in whose clinic both tetanus and gas-gangrene serum are continuously injected, never saw a case of serum shock.

The authors undertook animal experiments and were able to ascertain that in guinea pigs and rabbits repeated injections given subcutaneously only very rarely produce a serum shock. During the last one and one-half years, 7 cases of tetanus were seen at the Hamburger Clinic. At this clinic the wound of entrance is excised as radically as possible and is left open. Salves are not used because of the danger of obstruction. Hydrogen-peroxide drip is used but none of this substance is injected into the wound. High doses of concentrated 2,000-fold protein-poor serum are given intravenously and intramuscularly at the same time. The intralumbar injection has been completely abandoned since Schaefer has shown that the antitoxin passes out of the spinal sac into the blood within a few minutes after the injection is given and disappears completely from the sac within thirty minutes. The assumption that the blood vessels of the brain do not permit the passage of foreign protein and the antitoxin combined with the latter has not been proved. The assumption certainly does not apply to homogenous blood (blood from similar species), because at this clinic, blood from a very actively immunized donor was used for transfusion and was able to cure a patient suffering from tetanus; however, in this case in addition to the immunotransfusion, large doses of serum were also employed. The massive doses of serum injured neither the heart nor the kidneys (electrocardiogram). The assumption of Lohrband, that previous injection with local anesthesia containing adrenalin around the site of the serum injection will prevent serum shock, cannot be proved, as animals never develop serum shock from intramuscular injection alone. Aside from the above treatment, this clinic always administered avertin, mostly, however, during the night, in order to permit ingestion of nourishment and better ventilation of the lungs during the in-between period. In 3 cases a respiratory muscle spasm developed which, however, could be overcome by the immediate injection of evipan. Mitigal proved of great value in the treatment of the troublesome serum urticaria in this clinic.

(Franz). Harry A. Salzmann, M.D.

Rammelkamp, C. H., and Keefer, C. S.: Sulfathiazole Therapy of Staphylococcus Aureus Bacteriemia. *New England J. Med.*, 1940, 223: 877.

The authors report their experience in treating 7 cases of staphylococcus aureus bacteriemia with sulfathiazole. In each case careful studies were made of the effect of the drug on blood culture, white-cell count, and temperature, and frequent determinations were made of the concentrations of sulfathiazole in the blood.

Of considerable interest is the special investigation which they made of the influence of sulfathiazole on the staphylococcidal capacity of the whole blood of normal individuals and of patients suffering from staphylococcic infection. It was observed, in most of the experiments with normal blood, that if the original inoculum contained 1,000,000 organisms per cubic centimeter or less, complete sterilization of the blood occurred within forty-eight hours. The concentrations of sulfathiazole necessary for this effect varied between 2 and 6.7 mgm. per cent. In 3 experiments with the blood of patients suffering from staphylococcus aureus bacteriemia a marked increase in the bactericidal capacity of the blood was exhibited following the administration of sulfathiazole. Sulfathiazole was much more effective in this respect than sulfanilamide.

In the authors' series of 7 cases there were 3 recoveries and 4 deaths. The recoveries occurred in pa-

tients who developed abscesses which it was possible to drain surgically. The authors believe that the accessibility of metastatic abscesses to surgical drainage is more important in conditioning the successful outcome of sulfathiazole treatment than the age of the patient, and they believe that surgical drainage of localized staphylococcic abscesses is essential to recovery in most cases. Since sulfathiazole usually sterilizes or greatly reduces the number of organisms in the circulating blood, the drug should be of particular value in preventing the formation of metastatic abscesses when administered during the acute septicemic phase of the disease. In most cases it is necessary to continue the administration of the drug for a period of several weeks. JOHN S. LOCKWOOD, M.D.

ANESTHESIA

Halton, J.: Anesthesia in Chest Injuries. Physiology, Anesthetic Methods, Intratracheal Insufflation, Choice of Anesthetic Agent, Administration, Conduction of Anesthesia, and Oxygen Therapy. *Lancet*, 1940, 239: 675.

The author discusses the physiology of respiration in open pneumothorax.

Patients with chest injuries requiring immediate surgery are suffering from a lack of oxygen in the tissues, the anoxia of shock. If the chest is opened their respiratory exchange is further embarrassed by the physiological derangements produced by an open pneumothorax. This further increases the anoxia.

The author finds that the closed circuit method of anesthesia is mechanically and physiologically inadequate to combat anoxemia. In his opinion satisfactory anesthesia and efficient ventilation of the lung can be maintained only by intratracheal insufflation; the volume of air, gas, or air-borne anesthetic vapor blown into the lungs must be between 15 and 25 liters per minute, and the flow must maintain a pressure in the lungs of from 5 to 8 mm. of mercury and should never exceed 12 mm. of mercury. The diameter of the catheter must not exceed one-half of the diameter of the trachea.

Nitrous oxide or cyclopropane is ideal but too expensive. The author uses ether, but occasionally will use chloroform when there is extensive bronchial irritation or inflammation, or when diathermy is to be employed.

The apparatus must consist essentially of the following parts: a pump capable of delivering a steady current of air up to 30 liters per minute; an adjustable vaporizing bottle; an adjustable blow-off valve and a manometer; a set of Magill's nasal intratracheal tubes; and a set of gum-elastic intratracheal catheters with suitable unions for attachment to the delivery tube of the apparatus.

The author advises against the pre-operative use of opiates and barbiturates. He induces anesthesia rapidly with vinesthene or ethyl chloride, then switches to open ether or chloroform until the laryngeal reflex has disappeared. He rapidly introduces a Magill tube through the nose into the trachea by the blind technique.

The catheter is then attached to the delivery apparatus which should deliver 15 liters of air mixed with anesthetic vapor per minute. The cyanosis rapidly disappears and the adjustments can be made to maintain satisfactory anesthesia. Only rarely is it necessary to introduce the intratracheal catheter with the aid of a direct laryngoscope. The author thinks it is dangerous to push the anesthesia that deep and in such cases would do a tracheotomy and insert the catheter through the tracheotomy opening.

All of these patients should be placed in an oxygen tent or given oxygen through the B. L. B. Mask immediately after operation.

JULIAN A. MOORE, M.D.

Pitkin, G. P.: A Non-Oxidizing Epinephrine to Prolong Spinal Anesthesia with a Subarachnoid Capacity Control. *Anes. & Anal.*, 1940, 19: 241, 315.

There are two objectional features to spinal anesthesia which have not been overcome as have the many other objections in the past. They are insufficient duration for the completion of the operation, and the drop in the blood pressure. However, reexamination of the theories advanced to account for the drop in blood pressure have disclosed that a misinterpretation of some of the observed phenomena have prevented the progress necessary to overcome these objections.

In local and block anesthesia the use of a vasoconstrictor such as epinephrine or ephedrine helps to prolong the anesthetic effect. However, epinephrine injected intravenously or intraspinally has a temporary effect most likely due to oxidation. It has been found experimentally that epinephrine could be so treated that it would not oxidize in the spinal fluid of animals for several hours. This prolongs the anesthetic effect and at the same time helps to maintain the pressor effect of the vasoconstrictor. The fall in blood pressure with spinal anesthesia is not due to the effects of the anesthetic on the white rami, the vasoconstrictors, the sympathetic ganglia, or the postganglionic fibers as heretofore believed. Many experiments show that the stabilized blood pressure in spinal anesthesia is dependent primarily on a normal function of the suprarenal glands and the stabilizing secretion of the paraganglia. A new solution which the author has used to maintain the pressor effect and prolong the anesthetic effect has the following composition: each 6 c.cm. ampoule of the solution contains suprarenin .36 mgm., ephedrine hydrochloride 50 mgm., gliadin acetate 10 mgm., novocaine 300 mgm., alcohol .7 c.cm., and distilled water q.s. 6 c.cm. This produces a solution much lighter than spinal fluid with a specific gravity of .983.

The heavy solution is prepared by displacing some of the water with a sufficient amount of glucose to give the solution a specific gravity of 1.025. The

gliadin acetate is a viscous tenacious substance having glue-like properties. It is readily soluble in weak alcoholic dilutions, and forms a water-white solution. On contact with the spinal fluid it precipitates, forming a semi-permeable osmotic membrane between the spinal anesthetic solution and the spinal fluid. This membrane permits the liberation of the suprarenin and the anesthetic by osmosis. The porosity of the osmotic membrane is such that it tends to synchronize the liberation of the suprarenin-ephedrine and anesthetic drug, and render the liberation of one entirely dependent upon the other.

This solution may be used as a solvent for any local anesthetic—novocaine, neocaine, pontocaine, nupercaine, or metycaine. Its vasoconstrictor properties not only stabilize the blood pressure but intensify and prolong the anesthesia. Three hundred mgm. of novocaine or neocaine will give upper abdominal anesthesia from two to two and one-half hours; 200 mgm. will produce lower abdominal anesthesia for three hours; 100 mgm. confined in the sacral segments of the dura will prolong perineal anesthesia for more than three hours; 20 mgm. of pontocaine will produce upper abdominal anesthesia from two and one-half to three hours, and lower abdominal anesthesia from four to five hours; 7 mgm. of pontocaine pocketed in the lower end of the canal will give perineal anesthesia in excess of five hours.

The preparation of the new spinal anesthetic solution is the result of experiments conducted to prolong the duration of novocaine as used in spinal anesthesia. Suprarenin was used primarily for its vasoconstrictor properties. It was observed that not only was the duration of anesthesia extended because of the localized vasoconstrictor action, but also the pressor effect was prolonged so that the blood pressure could be maintained for several hours even when the nerves to the suprarenal glands had been anesthetized.

The usual precautions as to position of the patient with the heavy or light solutions must be observed. The patient remains in good condition during and after operation. The pulse is full and blood pressure is sustained, and sedation is induced by morphine and scopolamine prolonged with scopolamine. With the new solution hypotension is not a contraindication to the use of spinal anesthesia. Spinal anesthesia requires for its greatest usefulness a well qualified professional anesthetist if the objections to this form of anesthesia are to be reduced to a minimum.

MANUEL E. LICHTENSTEIN, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Davenport, C. B., and Renfroe, O.: Adolescent Development of the Sella Turcica and the Frontal Sinus, Based on Consecutive Roentgenograms. *Am. J. Roentgenol.*, 1940, 44: 665.

This study was undertaken to ascertain the changes that occur in the sella in the same child in successive years and to tie them up, if possible, with growth changes of the individual. Previous investigations made by others for similar purposes are reviewed briefly. In this study, roentgenograms of the heads of 46 boys and 50 girls between the ages of ten and eighteen years were made annually for five years, and comparative measurements served as the basis for the conclusions drawn. The technique used in making the exposures and computing the sizes is described in detail, and the results are tabulated. The conclusions reached are summarized as follows:

The area of the sagittal section of the sella turcica varies between the ages of ten and eighteen years, usually increasing with age, but in some individuals apparently decreasing, at least for a time. It varies with sex. Thus in children of fifteen years, the mean for 23 boys was 81.09∓4.02 sq. mm., and for 34 girls it was 92.94∓4.07 sq. mm. It makes about the same annual increase in both sexes between the ages of twelve and eighteen years, which indicates that the sex difference is established early. There is probably a real, though slight, correlation between the area of the sella and body weight, but the amount of increase in sella area in any period and the increase of weight in that period are not significantly correlated though sella area in relation to brain-case area is fairly strongly correlated with body weight at the same time.

Roentgenograms used in the study of the sella also served to determine changes that occurred in the cranium during adolescence, especially in the development of the frontal sinus. The method employed for making comparisons in successive years is described and illustrated. Comments relative to pneumatization are included and the significance of the frontal sinus is discussed. The authors' findings are presented in the following summary:

A series of roentgenograms taken at different ages on the same individuals shows that the frontal sinus begins by a destruction of the spongy layer of the frontal bone above the ethmoid. Into the space thus formed the nasal epithelium outpockets. The sinus thus initiated enlarges as the osteoclastic process continues. At the same time the frontal bone in this region thickens and the outbulging may affect chiefly the inner face, or the outer face, or both faces of the frontal bone. The degree of development of the sinus is varied at adolescence from 0 to 700 sq. mm. in cross-section at the glabella. The development of the frontal sinus is a special case of pneumatization. It is probably a rudimentary process, as it is relatively unimportant for man in whom the skull is balanced on the vertebral column.

ADOLPH HARTUNG, M.D.

Pfeiffer, R. L.: Localization of Intra-Ocular Foreign Bodies with the Contact Lens. *Am. J. Roentgenol.*, 1940, 44: 558.

Inasmuch as the Sweet method for localization of intra-ocular foreign bodies which has been in general use is not adaptable to improved or shock-proof roentgenographic equipment, some other method which can meet the requirements satisfactorily seems indicated.

For the past seven years the author has used an entirely adequate and satisfactory technique which employs a minimum of apparatus and which is easy as well as accurate. It gives a meridional localization, which is the easiest of all for the surgeon to interpret in the operating room. It utilizes a specially constructed Comberg contact lens in which the limbus of the cornea is designated by lead markers. Films made with it in the postero-anterior and lateral directions present images which lend themselves to plotting of the foreign body accurately in two planes. Detailed descriptions and illustrations of the procedure and apparatus used are included. Sources of error and means for their correction are also given consideration.

The use of stereoscopic films before localization is undertaken has the advantage of showing the presence of a foreign body. Bone-free films taken after the manner of Vogt are also advised as they may reveal foreign bodies in the anterior segment of the eyeball or eyelids not visible on films made in the usual manner.

In the cases presenting foreign bodies located deeply, in which there may be doubt as to whether they are in the eyeball or orbit, injection of a small amount of air in Tenon's capsule permits visualization of the posterior segment of the globe and suitable exposures will lead to the differentiation.

ADOLPH HARTUNG, M.D.

Fig. 1. The contact lens especially adapted with four radiopaque markers for roentgenographic localization of intra-ocular foreign bodies.

RADIUM

Pfahler, G. E.: The Treatment of Cancer of the Lip and Mouth. *Radiology*, 1940, 35: 598.

The greatest hope of preventing cancer of the lip and mouth lies in the thorough and skillful treatment of the lesions which precede cancer. Any erosion, fissure, papilloma, leucoplakia, induration, ulceration, or lump can be recognized and diagnosed almost from the day of onset. By making an effort to treat such lesions, many early cancers will also be reached and cured.

Treatment of precancerous lesions. Erosions or fissures will likely disappear after removal of their causes or after one or two applications of silver nitrate. If after two weeks the lesion fails to heal one may resort to local destruction by electrodesiccation. The latter is used also for the treatment of the papillomas. Leucoplakia demands the complete and permanent cessation of the use of all forms of tobacco, the removal of foci of irritation from the teeth, or energetic anti-luetic therapy if syphilis is the causing agent. In progressive cases, electrodesiccation followed by an erythema dose of unfiltered or lightly filtered radium plaque is indicated. Induration, ulceration, or lumps may easily be due to cancer and therefore they are treated with this view in mind.

Early cancer of the lip. The author prefers electrosurgical desiccation to destruction by irradiation in all early cases of cancer of the lip. The larger and more advanced cancers can also be treated by electrosurgery and if necessary the defect can be closed by plastic operation after the cancer is cured. However, a better cosmetic result is obtained from treatment by radium molds or radium needling. A statistical compilation of 309 cases shows that five-year cures were obtained in 98 per cent of those lesions up to 1.5 cm. in diameter; in 68 per cent of the larger ones; and in 48 per cent of those with palpable lymph nodes.

Cancer of the mouth. This is a more serious lesion because metastasis is likely to occur early and it may be extensive. The best method of treatment is by irradiation, but the technique of application depends on the size, location, and extent of the lesion and the grade of its malignancy. The author prefers to administer in all cases a preliminary dose from 1,200 to 1,800 roentgens, to take a biopsy, and then to adapt the further technique to the pathological findings in the individual case. Generally, the preliminary irradiation is carried out with high-voltage roentgen rays or their equivalent with radium packs over the cheek and neck. The post-biopsy irradiation is manifold. In certain instances, radium needles are applied interstitially, in others radium tubes are used in the form of molds or surface applicators. Again in others further external irradiation is undertaken.

The author reports that in a group of 475 cases of cancer of the mouth, a five-year survival rate of 29 per cent was obtained; figures for the various locations were as follows: tongue, 27 per cent; bucca, 38 per cent; tonsil, 27 per cent; lower jaw, 29 per cent; palate and pharynx, 28 per cent; and floor of the mouth, 20 per cent.

Metastases from cancer of the lip and mouth. Prophylactic irradiation with roentgen rays over the mental, submental, and submaxillary regions is carried out in all early cases. In the advanced lesions with manifest lymphatic involvement, a block dissection of both sides of the neck may be performed, although the author prefers here too, the application of continuous radium packs over a period of about twenty-five days, or the use of protracted, fractionated high-voltage (200 or 400 kv.) roentgen therapy associated with transcutaneous radium puncture of the larger nodes. The technical procedure is described in detail.

All in all, irradiation is the preferable treatment for cancer of the lip and mouth.

T. Leucutia, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Spies, T. D., Swain, A. P., and Grant, J. M.: Clinically Associated Deficiency Diseases. *Am. J. M. Sc.*, 1940, 200: 536.

In a series of 1,250 consecutive malnourished persons in Ohio and Alabama, the diagnosis, predisposing cause, development, and specific therapy of nutritional diseases were studied. A diagnosis of pellagra was made only if characteristic mucous-membrane or dermal lesions, or both, were present; a diagnosis of riboflavine deficiency depended upon the presence of characteristic angular lesions of the mouth or ocular symptoms; a diagnosis of beriberi was made only in the presence of nutritional neuritis.

The diets of these patients were found deficient in the following manner: (1) calories—the average person received only 50 per cent of his estimated energy requirement; (2) protein—35 per cent deficient; (3) minerals—nearly all received substandard amounts of calcium, phosphorus, and iron; (4) vitamins—the average fell below the suggested standards for normal persons as follows: Vitamin A, 67 per cent, Vitamin B, 72 per cent, Vitamin C, 47 per cent, riboflavine 73 per cent.

Clinical response to specific vitamins was striking; best general clinical results were obtained when all specific substances were supplied and supplemented with yeast powder or liver extract. There were no fatalities due to these deficiencies in the treated cases and approximately 30 per cent of the patients were able to obtain positions to work steadily, whereas previously they had had ill health for years which interfered with their ability to work.

PAUL STARR, M.D.

Minot, A. S., and Blalock, A.: Plasma Loss in Severe Dehydration, Shock, and Other Conditions as Affected by Therapy. *Ann. Surg.*, 1940, 112: 557.

The authors define shock as peripheral circulatory failure due to a discrepancy in the size of the vascular bed and the volume of intravascular fluid. Failure of the peripheral circulation due to a reduction in the volume of the circulating blood is known as secondary or hematogenic shock. This condition may be a result of severe dehydration, extensive hemorrhage, nutritional edema, or loss of blood plasma into the tissue spaces due to increased capillary permeability from mechanical, chemical, or thermal trauma, or from anoxemia.

It is essential in the treatment of impending hematogenic shock to restore and maintain an adequate volume of intravascular fluid. The nature and amount of the fluid employed for this purpose must be adapted to the physiological requirements and the pathological handicaps of the individual patient. If there is no capillary injury the problem is relatively simple, but in the presence of increased capillary permeability the loss of plasma protein into the tissue spaces makes the problem more difficult.

If both water and electrolytes have been lost from the blood stream, both must be replaced. Water can be retained in the body only when it contains enough salt to make an isotonic solution. Glucose solutions alone cannot overcome dehydration when salts have been lost. If there has been a large loss of chloride ions, as in persistent vomiting, sodium chloride must be supplied. If sodium ions have been depleted sodium bicarbonate or sodium lactate should be given.

The method by which fluids are administered should also receive individual consideration. In many patients there are obvious handicaps to the administration of fluids by the gastro-intestinal or subcutaneous routes. The intravascular volume can be increased most effectively by supplying fluids intravenously. However, in patients with increased capillary permeability this method provides only a temporary increase. In a short time the plasma colloids become more dilute, tissue edema develops or increases, and the blood stream remains dehydrated. Under these circumstances sufficient colloid must be administered to retain fluid in the blood stream.

At present there is no specific way to reduce the permeability of injured capillaries. Colloid must be added to the blood stream fast enough to replace that which is lost, and to maintain an effective circulating volume. This can be accomplished most satisfactorily by transfusions of blood plasma.

EDWARD W. GIBBS, M.D.

Sadusk, J. F., Jr., Waters, L., and Wilson, D.: Anuria Due to Sulfapyridine Calculi. *J. Am. M. Ass.*, 1940, 115: 1968.

Two cases of complete anuria occurring during sulfapyridine therapy are reported. The anuria was due to blocking of the ureterovesical orifices by calculi. In both instances treatment by means of cystoscopy was successful. One of the patients died of a neurosurgical complication. The pathological changes in the upper urinary tract consisted essentially of marked tubular and capsular dilatation, congestion and vacuolization within the glomerular tufts, and an acute hemorrhagic pyelo-ureteritis extending into the adjacent renal medullary tissue.

WALTER H. NADLER, M.D.

Skiöld, N.: Relapsing Febrile Non-Suppurative Panniculitis. *Acta med. Scand.*, 1940, 105: 43.

The case of a fifty-one-year-old woman who had an active infection over a period of about four years is reported. This infection was revealed by a slight

increase of temperature with afternoon values up to 37.7°C. (once 38.3°C.), and an increased sedimentation rate. There were also electrocardiographic changes which pointed to endomyocarditis. In addition, changes of a definitely inflammatory nature were observed in the panniculus adiposus. These eruptions were bright red, painful spots on the skin, about 6 cm. in circumference, and below each one a subcutaneous nodule the size of a walnut could be felt. After they had been present a few days the redness would disappear and leave areas which looked like bruises. At that stage, the nodules would no longer be spontaneously painful, but they were extremely tender when pressed. Two to three weeks later the lesions would pale completely, but the tenderness to pressure would remain for several weeks more. There were usually one or two nodules of this kind at different stages of development on the extremities, and hardly would one pale, than another would appear. Wherever these changes extended to the surface of the skin, there were redness, tenderness, and infiltration, which gradually regressed and left a scar. There was never any suppuration.

Biopsy of a deeply imbedded subcutaneous nodule was made. The tissue consisted of fat tissue, divided into lobes by narrow strands of connective tissue. Scattered lipoblasts were found, and the whole formation had the same structure as a lipoma.

The nature of the infection could not be established. It was thought that perhaps a purulent infection of the teeth from which the patient suffered might have been of some significance since a greater dissemination of the lesions was observed at the same time that the infection became acute.

Various kinds of treatment were attempted during the patient's three hospital admissions. Despite these, and the extraction of 14 diseased teeth, the disease showed itself to be strongly resistant to treatment; rather the condition became worse.

SAMUEL H. KLEIN, M.D.

Adams, R., Jones, G., and Marble, H. C.: Tuberculous Tenosynovitis. *New England J. Med.*, 1940, 223: 706.

Thirty-six cases of tuberculous tenosynovitis have been treated at Massachusetts General Hospital during the past forty-five years. An analysis of the cases showed the average age of the patients to be thirty-six years; there were 21 males and 15 females. The right hand was involved in 22 cases; the volar surface was involved 25 times, the dorsal surface 13 times. The influence of occupation is inconclusive, but hard use of the hand may be a predisposing factor; the importance of a history of trauma is difficult to determine. There was no evidence of direct inoculation of the infection in this group. Thirteen of the patients had tuberculosis elsewhere in the body; however, the fact that the disease is frequently present without pulmonary infection is certain.

Early diagnosis may be difficult; later there is a gradually developing mass on the volar aspect of the hand with inability to completely flex or extend the fingers. Paresthesia from pressure on the median nerve may occur. One of the most valuable aids in making a diagnosis is the keeping of a daily four-hour temperature chart and a daily rise to 99.6° or 100.6° F. is suggestive. Finger motion may cause grating or creaking because of the accumulation of degenerated fibrinous deposits within the tendon sheath—so-called rice bodies; these and two-way fluctuation beneath the annular ligament mean a burned-out lesion. Suspected cases should be splinted from the beginning.

The pathological diagnosis was proved in 27 cases and established clinically in 9. Operation was performed in 33 cases, incision and drainage of fluctuant masses in 9, and resection of the involved tendon sheaths in 24. Follow-up of 6 of the drained cases revealed 4 failures and 10 failures among 17 patients treated by resection of the sheath. Two of the 3 patients who were not operated on recovered completely.

These results are none too good. It is striking that tuberculosis, a disease often considered a contraindication to necessary surgical procedures, should have been so avidly attacked when manifested in the tendon sheaths. Tuberculosis is a generalized disease and any focus is likely to be paralleled by similar infection elsewhere in the body. Tuberculosis of the tendon sheaths should receive the same systemic treatment accorded to tuberculosis of the lungs or spine. Surgical attack on a tuberculous focus such as a tendon sheath without knowledge of whether the lesion is progressing or regressing may result in failure. Such knowledge can be gained only by periodic observation, and during this time treatment in the form of splint immobilization and of the sanatorium type of care should be given. Again, it is axiomatic that the tuberculous patient must demonstrate resistance and an ability to localize infection before the surgical attack is made.

The best results at the Massachusetts General Hospital have been obtained in cases in which the hand has been disabled by the sequela of an infection that has become quiescent, that is, by fibrosis of the tendon sheaths, adherent tendons, and rice bodies.

HARVEY S. ALLEN, M.D.

Kleinenberg, H. E., Neufach, S. A., and Shabad, L. M.: Endogenic Blastogenic Substances. *Am. J. Cancer*, 1940, 39: 463.

Within the past eight years experimental studies of the production of tumors with chemically pure substances have been carried out on a large scale and have yielded important results. The question arises, however, as to how far the experimental conditions resemble those under which tumors originate in man and whether some endogenic blastogenic substances which are to a certain extent analogous to the exogenous substances now known may not occur in the human or animal organism.

The study of the structure of certain exogenic carcinogenic agents, namely, the polycyclic hydro-

carbons, has shown them to bear a close resemblance to substances which are known to originate in the human body, as for instance the sex hormones, bile acids, and cholesterol. Important support for the hypothesis that there are carcinogenic substances of endogenic origin was furnished by the preparation of methylcholanthrene from deoxycholic acid. For final proof of the endogenic origin of blastogenic substances, it is necessary to obtain from the human or animal body affected with tumors certain chemicals which will produce tumors in animals. A number of indirect proofs of the possible endogenic origin of blastogenic substances have been advanced and several attempts have been made to discover them but no direct experimental proof of the presence of endogenic blastogenic substances has yet been found.

On the assumption that endogenic carcinogenic agents might belong to a group of substances more or less akin to the exogenous carcinogens already known to us, the authors decided to use benzol as an extractive, inasmuch as it had proved to be an efficient solvent of a number of carcinogenic hydrocarbons. Considering the possibility of blastogenic substances circulating throughout the animal organism, the authors believed that they might be found outside of the tumor, and might be obtained from some organ which had not been affected by the growth. The first attempts were directed toward the liver, the organ which is undoubtedly connected with the conversion of sterols, and in particular is the site of formation of the bile acids.

Livers were obtained from 67 patients, of whom 41 had died of malignant neoplasms, mostly cancer, while the remaining 26 had died of various other diseases and gave no history of malignant growth. All the experiments were carried out on 537 white mice, which were two or three months old when the experiment was begun. The extract was administered subcutaneously by means of a syringe into the left side of the body. A dose of from 0.2 to 0.4 c.cm. was given repeatedly for from four to eight, and sometimes as many as twelve times, at intervals of from ten to twenty or thirty days. The period from the beginning of the experiment to the last injection thus varied from one to ten months.

Injections into mice of benzol extracts of the liver of persons who had died of cancer resulted in a large number of tumors, benign and malignant, originating both at the site of injection and, more frequently, at a distance. A comparison of the number and appearance of the tumors observed in these experiments with the number and appearance of those occurring spontaneously in the strain used, which has been under observation for twelve years, proves beyond doubt that the tumors in the experimental mice were produced by the injected liver extracts. The injection of bile extracts from cancer patients, as shown by previous investigations, produces approximately the same number of tumors as the injection of liver extracts from cancer patients. The extracts used in both series of experiments—i.e., those with liver extracts and those with bile extracts—were obtained from persons with cancer of different forms and locations and consequently the results are not to be attributed to any particular peculiarities of cancer affecting the stomach, the lung, or other organ, but to the general properties typical of malignant tumors of all kinds. The authors' study gives sufficient grounds for concluding that extracts made from a liver devoid of any metastases may cause tumors, i.e., that the blastogenic agent may be present outside the tumor itself. Extracts prepared from the livers of persons who had never suffered from cancer produced considerably fewer tumors than "cancer extracts," i.e., extracts from persons suffering with cancer, and at a much later age. The accumulated data support the conclusion that the tumors observed, or at any rate the great majority of them, were caused by the injected extract. The resulting malignant and benign tumors closely resembled, both in their morphology and in their variety and location, the tumors observed in mice following the injection of exogenic blastogenic substances.

The origin of tumors at the site of the injection of the liver extract might conceivably be attributed to the chronic irritation produced and the subsequent repeated regeneration, i.e., to a non-specific local irritating action, which, of course, actually took place. Opposed to this point of view are all the observations made in experimenting with chemically pure exogenic substances, which clearly show that there is no connection between the origin of the tumors and the irritating properties of the agent. In the second place, no tumors were found at the site of the injections of bile extract, although bile extracts have a far greater irritating action than liver extracts. In the third place, it is worth noting that liver extracts from non-cancerous patients had no less an irritating effect than cancer extracts, yet the number of tumors they produced was far smaller. Last, but not least, neither non-specific irritation nor local chronic inflammation can possibly account for the origin of tumors remote from the injection site, which were very numerous in the authors' experiments.

In spite of all this, it is necessary to consider the question as to whether the authors truly succeeded in extracting blastogenic substances from the human liver or whether these substances were obtained as a result of their treatment of the organ and the preparation of the extract. Various considerations induced them to conclude that the benzol extracts employed by them contained only such blastogenic substances as had previously existed or had been previously formed in the liver. The investigations do not yield any data concerning the chemical nature of endogenic blastogenic substances.

JOSEPH K. NARAT, M.D.

Hieger, I.: The Examination of Human Tissue for Carcinogenic Factors. *Am. J. Cancer*, 1940, 39: 496.

Numerous experiments have been carried out to see if a carcinogenic factor could be detected in ex-

tracts of tumors or of tissues and body fluids from human subjects who have died of cancer. The author has used, as test methods, applications to the skin of the mouse, fluorescence spectroscopy, and inhibition of the dehydrogenase system such as is brought about by derivatives of some carcinogenic compounds.

Shabad, working in Leningrad, has been the first to report success in this field. His experiments were carried out on mice with liver tissue obtained from a woman dying of gastric cancer with numerous metastases, but none in the liver. Three tumors were obtained: 2 sarcomas in male mice after eight and three-quarters and nine months, respectively, and a carcinoma of mammary type in a female after nine months. The experiments described are mainly an examination of Shabad's discovery, and the extension of it to other tissues.

Primary cancer of the liver is of common occurrence among the Bantus of South America, the Javanese, and the inhabitants of some parts of Eastern Asia. These facts suggest certain possibilities: (1) that in some races, such as the Bantu, the liver acts as a depot for some carcinogenic agent; and (2) that the incidence of cancer in these areas is a consequence of some dietetic factor. The adrenal and the prostate glands have been used also for the preparation of extracts; the adrenal because in recent years many new compounds have been isolated from it, and the prostate because some pathologists believe that a considerable number of enlarged prostates have malignant areas. Other organs, which are known to contain tissue in a precancerous condition and obtainable in quantity from the operating room were also used.

The number of animals and procedures used were as follows: injection of extract of liver, 367 animals; injection of extract of adrenal gland, 10 animals; injection of extract of prostate gland, 20 animals; injection of lard (controls), 70 animals; painting with extract of liver, 40 animals; feeding, 325 animals.

Eleven spindle-cell tumors were obtained in 367 mice receiving subcutaneous injections of various extracts of European and Bantu livers.

Of these 367 mice, 60 were females and in these 10 of the 11 tumors occurred. The lack, however, of a sufficient quantity of any one extract for an adequate test upon male and female mice prevented any conclusive experiment on the susceptibility of the two sexes. Extracts of the adrenal and prostate glands have so far given negative results.

Obviously, there is no simple relation between cancer in a human subject and a cancer-producing factor in the liver. It is unknown why only certain livers yield active extracts, and, beyond the slight indications given by the method of saponification and extraction, there is nothing to suggest the nature of the compound concerned. The small proportion of active extracts seems to exclude any ordinary constituent of the liver and bile, such as deoxycholic acid.

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GENERAL BACTERIAL, PROTOZOAN, AND PARASITIC INFECTIONS

Neuber, E.: Specific Diagnosis and Therapy of Actinomycosis (Spezifische Diagnostik und Therapie der Aktinomykose). *Klin. Wchnschr.*, 1940, 2: 736.

In a detailed work Neuber, Director of the Dermatological Clinic of the University of Budapest, reports on a new specific treatment (autohemotherapy) in cases of actinomycosis. He analyses the value of various diagnostic and therapeutic methods and gives a critical survey of the types of actinomycosis which most readily respond to the different and particularly specific therapeutic methods.

The clinical material consists of approximately 300 patients. Neuber points out a fact which has not been sufficiently appreciated in other reports, namely, that bacteriological proof and cultures of the ray fungus do not suffice for diagnosis; the clinical picture has to be considered in all cases, and the latter must show the characteristics of a chronic specific inflammatory process. Ray fungi are found frequently merely as saprophytes in various ulcerous processes of the skin without influencing the development of the clinical symptoms. Whether we have to deal with a saprophytic or pathogenic strain must be determined with a culture and preparation of a vaccine from it, the latter to be used for study of allergic intracutaneous reactions. If the reaction in the patient (not anergic) is positive, we can be sure that the fungus is of pathogenic origin and is the causative agent of the illness in question.

In the diagnosis of actinomycosis allergic reactions play an important part. However, dependable antigens are necessary; they must be specific and sensitive. Fresh vaccine is of the utmost importance. For the preparation of the vaccine one uses, if possible, cultures originating from the patient after one or two inoculations. A polyvalent antigen (vaccine) prepared from 6 to 8 different strains proves most successful. Complement combination appears valuable particularly for the early diagnosis of ray fungus in the internal organs. The difficulty lies in the preparation of a dependable antigen. Among the specific therapeutic methods the specific vaccine treatment must be stressed as one which gives very good and dependable results.

Lately Neuber has developed the specific treatment with serum taken from convalescing patients, blood transfusions, and autohemotherapy, all of which methods have given good results. Every one of these methods represents a great therapeutic advantage, and in some aspects they complement each other. Vaccine treatment should not be attempted in an anergic condition, but if this is overcome, vaccine, being an active immunizing factor, shows the best permanent results. On the other hand, serum from convalescing patients, specific blood transfusions, and autohemotherapy can be used also during the anergic stage, because with these methods the patient acquires immunizing substances which

he need not produce himself as is the case with vaccination; however, the effect of these passive immunization methods is not as permanent, particularly when convalescent serum is used. In consideration of this fact Neuber gives in the beginning, particularly in cases of anergic patients, passive immunization (eventually combined with gold—Solganal B. ol. altogether 2.5–5.0, pro dosi 0.01–0.25); later, when the anergic condition has been overcome, the author gives active immunizing treatment which most effectively guards against relapses.

Autohemotherapy represents an energetic therapeutic measure. Eight cases were treated with this method alone and all of the patients recovered completely. In 9 cases autohemotherapy was combined with gold treatment. These cases also showed excellent results. The value of this method lies in the fact that it can be used also in cases of anergic patients and that the material is easily obtainable, in contrast with methods which use convalescent serum and blood transfusion. In the course of autohemotherapy the patient receives, at five-day intervals, 5, 10, 15, and 25 c.cm. of blood. In the cases cured entirely by autohemotherapy from 12 to 15 injections were necessary.

In conclusion, Neuber points out that these specific therapeutic measures will cure patients with actinomycosis almost without exception. Success is based upon the following conditions: only dependable antigen should be used; dosage should be determined according to biological rules; and no vaccine treatment should be given in serious cases during the anergic stage.

Patients with actinomycosis who are unable to recover their ability to react even with the help of gold and passive immunization methods are incurable; quite hopeless are also such cases which reveal a degeneration of the vital internal organs, for instance, parenchymatous and amyloid degenerations. Six illustrations accompany the report.

(Dumont). Hilda H. Wullen.

SURGICAL PATHOLOGY AND DIAGNOSIS

MacGregor, R. G. S., Richards, W., and Loh, G. L.: The Differential Leucocyte Count. *J. Path. & Bacteriol.*, 1940, 51: 337.

The differential leucocyte count, widely used as an aid to diagnosis, has also been used as a means of determining physiological variations and in the assessment of normal standards in different environmental conditions. Two common errors occur: (1) errors due to variation in the method of taking blood for films, and (2) errors due to variation in the method of performing the count. Three different methods of counting were employed: (1) the straight or edge count, (2) the "battlement" or "palisade" count, and (3) the "cross-sectional" count.

Differential leucocyte counts performed on slide films showed marked variations, particularly in the percentage values of polymorphonuclears and lymphocytes, in different areas of the same film.

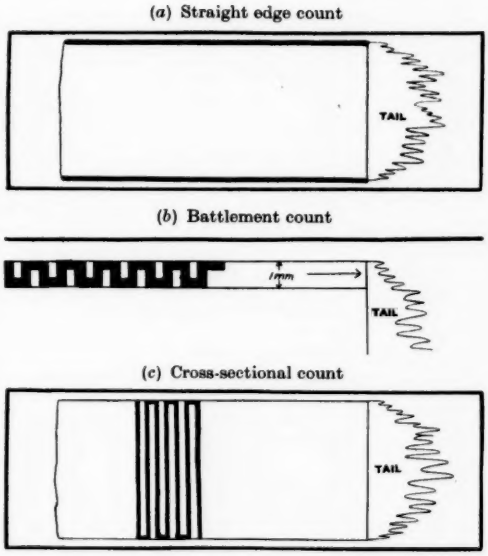

Fig. 1. Common methods of counting films. The areas examined are shown in black in all three diagrams.

Three common methods of performing the differential count were shown to give, on the same film, variations which exceeded 20 per cent in certain types of cells under certain circumstances.

Examination of all fields in a series of full-sized films and in films of varying dimensions showed that cells of different types had different distributions, but that there is a general relationship between the distribution equation of one type of cell and that of any other type. This general relationship varies to some extent for the individual film, but for a series of films is relatively constant.

This relationship was ascertained from examination of consecutive segments throughout the films, the results of which were subjected to Fourier analysis to determine the nature of the wave distribution of cells, and factors were obtained which could be expressed in the form of graphs. These graphs correlate three common methods of performing the differential leucocyte count with the count determined from examination of all cells in the film, and allow corrections to be made which render these methods comparable, the degree of correction varying with the type of cell and with the percentage found for the type in question.

The accuracy of these corrections was tested upon a series of differential counts covering a wide range not included in the series from which the graphs were constructed; the average error was found to be less than 3 per cent. When average results obtained from two methods are being compared, a correction of as much as 20 per cent may result in certain cases.

This degree of accuracy would hold for averages of series of films made with sufficient care to ensure that the standard type of film was maintained. Variation from the typical film would decrease the accuracy with which such factors can be applied, although it would still give a considerable degree of correction.

A modification of the degree of accuracy with which the correction could be applied would also be brought about by including in the series blood which gave values for total cell counts per cubic millimeter outside the normal range, since physical factors governing the spread of films would be affected to some extent when the cell concentration is altered to the degree possible in all pathological cases.

The chief scope of this type of standardization of the differential count lies at present in its application to the determination of the physiological values of blood in groups of normal individuals of different types or under different environmental circumstances, or to variations in cell percentage which are not accompanied by extreme alterations in total values for red and white cells per cubic millimeter.

The type of differential slide film count which gives the closest value to that found by a count of the whole film is the battlement edge count, performed in the manner described, with due consideration of both edges to diminish errors caused by asymmetry of the film.

Counts performed on coverslips tend to give a slightly higher value for polymorphonuclears and a lower value for lymphocytes than those given by the slide film method and correspond reasonably closely to the straight edge type of slide film count.

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EXPERIMENTAL SURGERY

Siebert, W. J., and Loose, F.: Comparative Studies on the Absorption of Sulfanilamide. *J. Lab. & Clin. Med.*, 1940, 26: 371.

Comparative studies were made on the absorption of sulfanilamide administered as a solution in glucose, glycerin, and sodium lactate, and as ordinary tablets. Six apparently healthy adults and 2 patients with pernicious anemia were studied. Higher blood concentrations of free sulfanilamide were obtained when the drug was given in the solution than when an equivalent dosage was given in the form of tablets. With the solution the rate of sulfanilamide elimination was no more rapid and the loss of blood carbon-dioxide combining power was less, and in the presence of achlorhydria the rise in the blood concentration of sulfanilamide was comparable to that seen in the normal subject. Therefore, gastric hydrochloric acid is not required for the absorption of sulfanilamide into the blood stream.

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